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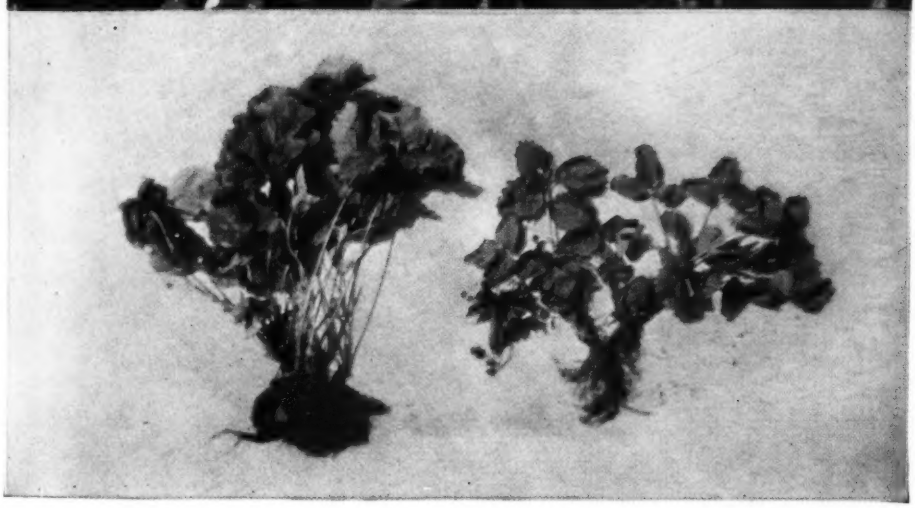

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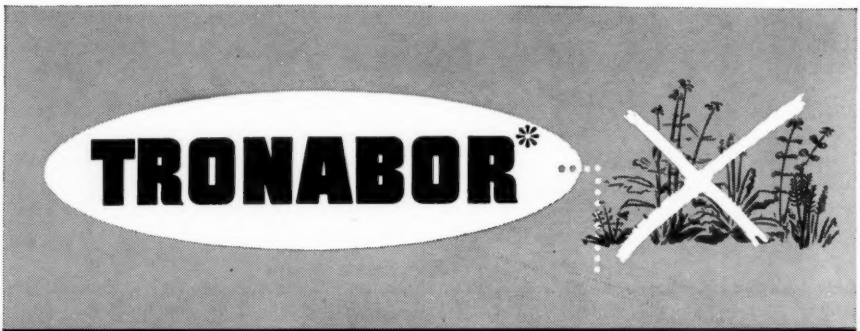
The Pocket Book of Agriculture



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• • • • •

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVII NO. 5

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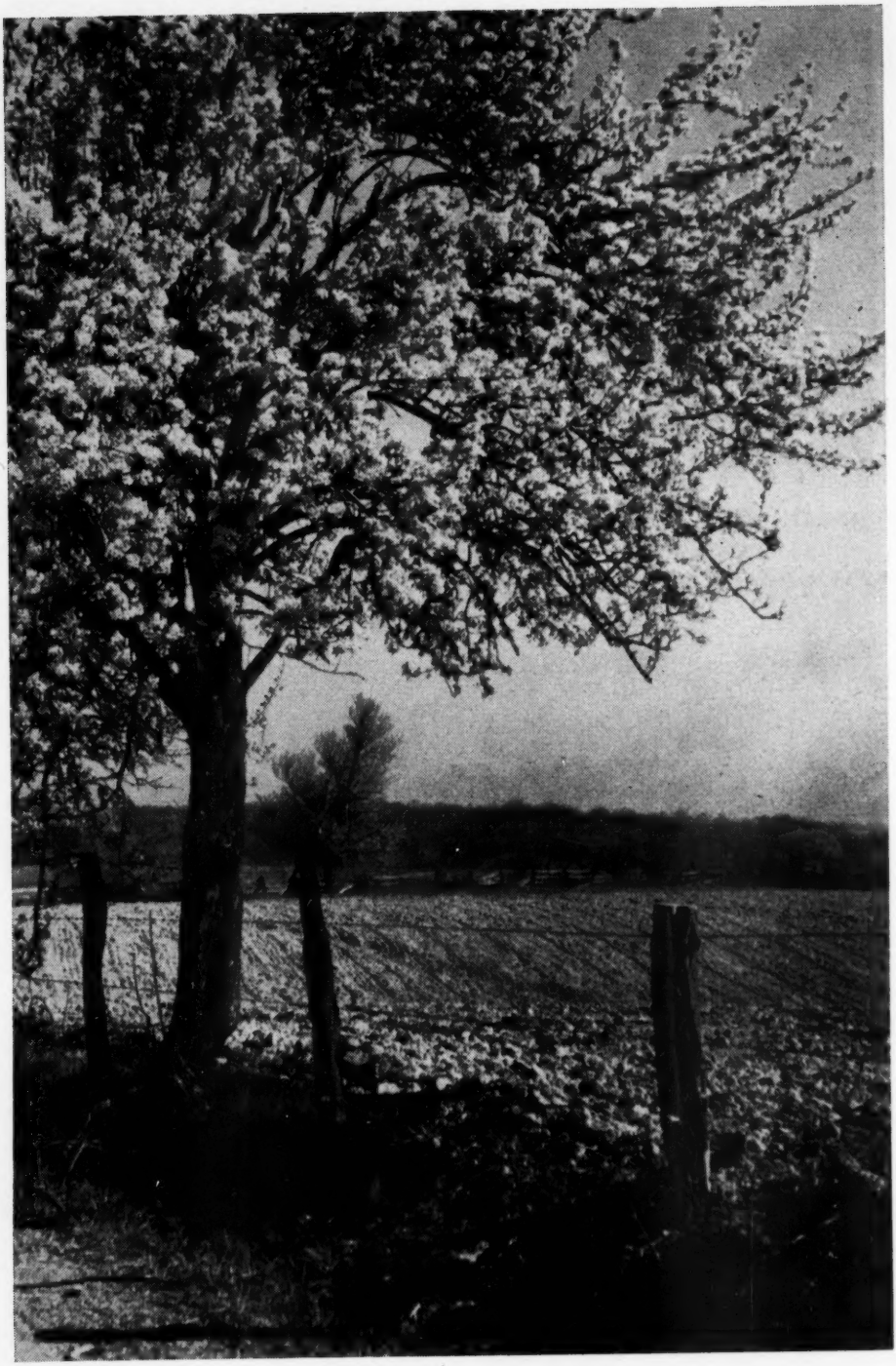

Readying for Planting

Better Crops with PLANT FOOD

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VOL. XXXVIII WASHINGTON D. C., MAY 1954 No. 5

A look through . . .

Opening Doors

Jeff McDermid

EVER since I hit an agricultural college campus for the first time more than 40 years ago and got well acquainted with the fellows who went there and the professors and instructors who taught them, I have never known a more unselfish and devoted group, or one where good fellowship prevailed to a greater degree. Since those days great changes have occurred in the agricultural scene. Back then most of the lads who came to study at our state college intended to be farmers or teachers and extension agents, with emphasis on direct production on the land. That was quite a spell before the field of agriculture as we know it now had branched out and flowered profusely in the myriad of careers which time, research, expediency, progress, and the rise of the commercial farm produced.

Today there is keener competition in farming and keener competition in agricultural education than in those formative years gone by. Similarly, there is greater demand for ready cash and big investments in both farming and college institutions than there was back then. This in turn spells a need for better trained farmers and better equipped educational agencies.

The real rise of the agricultural college to greater complexity, heavier financial budgets, and larger staffs began when dirt farming—direct pro-

duction effort—fell into fifth or sixth place as a profitable career for graduates. From 10 to 20 per cent of the present-day graduates of our state agricultural colleges engage in direct production, while 80 to 90 per cent in many cases find lucrative and inspiring jobs in the professions and services allied to agriculture that require a sound basic agricultural training plus elective specialties in the social and physical sciences and other exacting skills.

Let's back up at this point and size up the value of a course in agriculture, the open door to numerous fascinating careers. One thing that youngsters should always look into is the permanency of a given profession before casting in their lot and a lot of mazuma besides. You'll scan the list of occupations a long time before you find one that has a brighter long-time future than farming and the careers that cater to it. Quieting hunger is apt to remain a must.

Next, a young fellow likes to join up with a big outfit. Well, this is where agriculture shines some more. Agriculture uses about 40 per cent of the presently employed national working force. It also utilizes more supplies and raw materials than any other industry. Fully 60 per cent of the nation's land area lies within the borders of somebody's farm.

YOUTH always prefer to mix up with new discoveries and fresh formulas and be right in there pitching in the big league. Here again agriculture scores. Its rapid rise in output and the increased skill and efficiency it demonstrates are unsurpassed by any other U. S. industry. This is especially true in its application of scientific discoveries and the constant farm demand for new research in production, processing, and marketing.

The rising generation like an education but they wish to know if the brand they imbibe is really relied upon to keep the world moving. They don't want a quick jag in education, but a system that stays with them. Agriculture relies on higher education—science, business affairs, finance, engineering, communications—all being required to meet normal everyday problems successfully.

Because of these valid reasons—stability, permanency, size, new ideas, continuous learning, variety, efficiency—agriculture probably offers more opportunity and satisfaction to college graduates than we find in most other pursuits. In farming and ranching and in every special skill from agronomy to zoology, agriculture is in a class by itself.

But there are always two sides to education—the school side and the side of the student. It is not possible as a rule for a faculty of an agricultural college to turn out A-1 graduates from defective raw material. The prospective student should have reasonably sound health, a real liking for country life and associations, and be a good learner and observer. He must have ability and desire to study and get good grades. He ought to have enough reserve credit or financial income to insure his investment in education until ready to begin "cutting coupons" on it.

But if he finds a way to begin farming without assuming too big a burden, he has need of a multitude of skills and know-hows, because the actual investment in well-organized farms behind every farm worker is about thrice that behind each factory worker.

SOMETHING powerful happened to American agriculture recently to enable it to increase total output 44 per cent above 1935-40 while the population increased but 24 per cent. Maybe favorable growing weather helped, advice of old-timers' did its share, and the deeper resources of the land played a part also. But the forces of research and education in every field of agriculture must get the

praise for most of the new era's abundance. Our centers of learning again provide the nursery for another remarkable renaissance.

The institutions that are the closest to the farmer and his family are the Land-Grant colleges—54 in all. Here are depositories of science and practice, always open to the farmer, the student, and the whole vast array of agricultural enterprises. Unlike the previous

custom of the Old World countries where the secrets of science were locked off and seldom given to the ones best able to use them, our college doors are unlatched. Not only that, but extension agents and Smith-Hughes teachers carry the findings of fact to every community willing to listen.

About half of the graduate roster at many of our agricultural colleges finally wind up with careers either in business and commerce or in some branch of public service connected with farming and stock raising. Only a relatively small percentage go far enough in the basic sciences to make research their full-time life work. Science, like art, takes exacting, devoted, and often plodding enthusiasts.

One prominent state college in a survey of some 3,000 alumni finds that about 51 per cent of them report being in business and industry or in state or federal employment. Only 5 per cent or so said they were engaged solely in scientific research—but this, of course, varies by institutions. The demand for highly skilled research personnel is rising, and the U. S. Department of Agriculture and the state stations have probable replacement positions ready for 12,000 or more exceptional people between this date and January 1960.

Business offers tremendous opportunities for obvious reasons. Farmers have enormous investments in land, buildings, machinery, equipment, electricity, and livestock. These often take more capital than the small-town mercantile business does. The latest estimate of Wall and Associates of USDA gives national agriculture total combined financial and physical assets of $165 billions. Debts and liabilities amount to less than $20 billions. Back before World War II agricultural assets were only $53 billions. Big business grows fast.

Hundreds of jobs arise with private banking and insurance corporations, cooperative credit institutions, and the federal land banks. Their farm specialists must know farm costs and expenses, and be able to analyze the net worth of loans and investments. Trained farm managers are in steady demand on large and small estates. Farm appraisers likewise must have solid backgrounds without guesswork.

Direct marketing of farm products affords another promising field. Buying and selling are the lifeblood of agriculture and the production and distribution of food and fiber. Salesmen help farmers—or are supposed to—in making investments in operating materials and facilities suited to their own needs and financial standing. Farmers must sell shrewdly and carefully map out merchandising programs —either alone or with other farmers. Here there is a growing need for specialists to help market quality goods, graded and labeled right, and then advertised and distributed properly.

ALL the myriad of manufacturing supply companies in the whole

(*Turn to page* 49)

Demonstration Farms Produce Efficiently With Grass

By Edward M. Henry

Test Demonstration Agricultural Extension Service, Jonesboro, Tennessee

ONE may hear of various suggested solutions to the projected problem of feeding and clothing our future population. Certainly we will need greater agricultural production to meet the needs of our predicted 200 million population of 1975. With the expansion of new land frontiers limited, the opportunity for increasing our agricultural output horizontally is not encouraging. Possibly each acre of farm land will be called upon to produce one fifth more. Can this vertical expansion of our agricultural production be brought about?

The pattern of increased agricultural production on a group of unit test demonstration farms in Washington County, Tennessee, may invoke some thought in arriving at the answer. While this same pattern of development is not applicable to all sections of our nation, the fundamental factors considered in getting greater production from this group of farms may apply in many areas. Good land use, soil building, use of adequate plant nutrients, and good farm-management practices are all of vital importance in making these rather small owner-operated farms examples of intensive, efficient production.

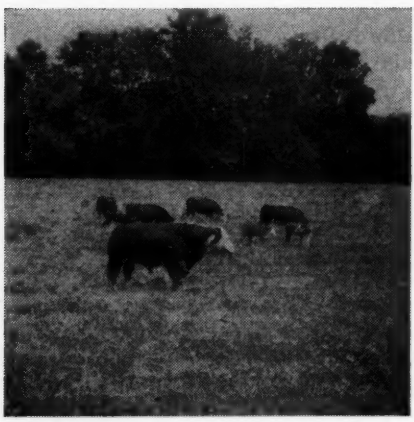

Fig. 1. Brood cows in this herd of purebred cattle have never eaten grain. A good mixture of grass-legume herbage produced on well-fertilized soil and used as pasture and hay keeps the cows in good, thrifty condition.

The topography, rainfall, and soil types of Washington County are typical of a large area of upper eastern Tennessee and southwestern Virginia. The land is rolling to steep, with much of the soil derived from limestone. Although this county has produced considerable corn and small grain in the past, it is fast becoming one of the outstanding grassland counties of the nation. This grassland farming pattern supports both dairy and beef herds, and is supplemented with burley tobacco as a cash crop. Egg production on some farms is a contributing enterprise.

To make a grassland program efficient on these small farms (the average size farm of the county is less than 50 acres) it must be developed intensively. The 29 unit test demonstration farmers cooperating with the Agricultural Extension Service and the Tennessee Valley Authority are finding the key to such a development, and are setting an example for other farmers to observe and follow. With the farm plans built around a good pasture and hay program through the liberal use of plant nutrients, and the forage utilized

through good livestock, these farmers are getting high farm production compared with that of the average farmer for the county and State.

A comparative study (see Table I) shows that these demonstration farms have one third as much row crops as the average farm of the county or one sixth as much as the average Tennessee farm. These farms are leading in the increase of alfalfa acreage, since through adequate fertilization the demonstration farmers find they can successfully maintain their stands for several years. The intensive development of the pasture and hay crops enables these farms to carry 2½ times the volume of livestock on equivalent acreage, compared with the average Washington County farm. Such an intensive development of this grassland program can be attributed partly to the liberal use of plant nutrients. These demonstration farmers are using over 2⅓ times as much fertilizer per acre as the average county farmer, and four times as much as the average Tennessee farmer.

This type of farm development reflects into the farm output, since the per acre farm sales from the demonstration farms are 2½ times greater than those from the average farm of the county.

The sward of most of the pastures on the demonstration farms consists of orchard grass-ladino clover-alfalfa or fescue-ladino clover-alfalfa mixtures. Often considerable hay is harvested from these fields during flush seasons of growth. The common rate of fertilization in establishing these pastures is 1,300 to 1,500 pounds of fertilizer per acre, which probably will include 33 pounds of N, 270 pounds of P_2O_5, and 100 to 200 pounds of K_2O. Annual maintenance application of 75 to 150 pounds of K_2O per acre is applied to most pastures. Additional phosphate is usually used every two to three years. Alfalfa usually receives an annual application of 150 to 200 pounds of K_2O and 20 to 40 pounds of borax per acre. Phosphate is applied to alfalfa when seeded at the approximate rate of 216 pounds of P_2O_5 per acre, and subsequent applications are made every one to three years, averaging about 50 pounds of P_2O_5 per acre. The longevity of alfalfa stands on these demon-

TABLE I.—COMPARISON OF TEST DEMONSTRATION FARMS WITH ALL WASHINGTON COUNTY AND TENNESSEE FARMS

	Wash. Co. Test Dem. Farms 1952 [1]	All Wash. Co. Farms 1949 [2]	All Tenn. Farms 1949 [2]
Number of farms	29	3,683	231,631
Acres of open land per farm	106*	36	50
Per cent of open land in row crops	4.7	13.6	27.6
Per cent of open land in corn	3.0	11.1	18.0
Per cent of open land in pasture and hay	84.9	75.0	53.0
Per cent of open land in alfalfa	12.6	2.5	1.6
Pounds of fertilizer used per acre of open land	375	159 [3]	92 [3]
Acres of open land per animal unit	2.6	5.6	7.5
Gross farm sales per acre of open land	$96	$37	$29
Per cent of farm sales from livestock and livestock products	81	64	46

[1] From records kept on the test demonstration farms.

[2] From 1950 U. S. agricultural census.

[3] For fiscal year ending June 30, 1952 (State Dept. of Agriculture Report) (1952 was one of the driest years on record for Washington County).

* The average size test demonstration farm is larger than the county average due to two rather large farms in this group. Most test demonstration farms run from 40 to 75 acres.

Fig. 2. Well-fertilized pastures such as this frequently provide more than 300 cow days of grazing per acre during one season. A two-year record of this field shows the cost of establishing and maintaining to be 7½¢ per cow day grazing. Net return was 41 cents for each cow day of grazing realized from this pasture.

strations is proving much greater than experienced on other farms using less plant nutrients.

Close check is kept on the pH of the soil, and lime is applied to both pasture and alfalfa fields when needed.

The Ross Wilcox test demonstration farm is a good example of how an intensively developed grassland program affects the farm output. This farm consisting of 62 acres of cleared land is rolling to steep in topography. The Wilcox family was selected by the people of their community for the test demonstration program in 1939. Mr. Wilcox then set about to change his farm plan from one based around a rotation of corn, small grain, and lespedeza to a grassland program stressing highly improved pastures and alfalfa for hay. He believed through such a program he could eliminate erosion, rebuild his soil fertility, reduce his labor requirement, keep more livestock, increase the volume of his farm sales, and operate his family-size unit more efficiently.

A study of the change that has taken place on the Wilcox farm during the 13 years from 1940 through 1952 reflects a large increase in farm output as well as greater efficiency of production. Corn and small grain production on this dairy farm has been discontinued. Alfalfa has replaced lespedeza for hay, and orchard grass-ladino clover pastures have replaced unimproved bluegrass and wild grass pastures. High-yielding pasture and hay crops have been developed through the liberal use of plant nutrients. One of Mr. Wilcox's alfalfa fields has averaged over five tons of hay per acre each year for three years, which is a high yield for this area. The yield of burley tobacco has more than doubled during this period.

Through the intensive development of a grassland program on this unit, the volume of livestock has been doubled. Adequate amounts of nutritious pastures and legume hay along with a good breeding program have doubled the herd's average milk production, which is now more than twice the average State production.

The volume of farm sales has increased 900 per cent during this period,

Fig. 3. Many farmers and agricultural workers visit the highly productive pastures on test demonstration farms to gain information on seeding, ferilization, management, etc. This is a field of orchard grass, ladino, and alfalfa used for grazing, with surplus growth sometimes used for hay.

while the net farm income was four times greater in 1952. In 1951, a near normal rainfall year, the net farm income was 75 per cent greater than it was in 1952, a year of serious drouth.

Certainly the use of fertilizer cannot be overlooked in analyzing the change which has taken place on the Wilcox farm. Table II shows the fertilizer used in 1939 compared with 1952. It might be pointed out that only a small percentage of the fertilizer materials used

TABLE II.—FERTILIZER USED ON THE ROSS WILCOX TEST DEMONSTRATION FARM

1939		*1952*	
2,500 lbs. 0–48–0 (Dem. material)		4,400 lbs. 0–27–0 (Dem. material)	
350 lbs. 3–8–5		5,700 lbs. 0–10–20	
375 lbs. 0–10–4		4,000 lbs. 0–20–20	
200 lbs. 0–0–50		7,200 lbs. 0–12–12	
100 lbs. 0–0–48		1,000 lbs. 6–12–12	
		200 lbs. 4–10–6	
		2,000 lbs. 3–9–6	
		2,000 lbs. 3–12–12	
		3,000 lbs. 33–0–0	
		200 lbs. 16–0–0	
		200 lbs. 20–0–0	
		2,000 lbs. 0–0–50	
3,775 lbs. Total		31,900 lbs. Total	Per A. average for farm
10.5 lbs. N		1,250 lbs. N	20 lbs. N
1,265.5 lbs. P_2O_5		3,982 lbs. P_2O_5	64 lbs. P_2O_5
170.5 lbs. K_2O		4,296 lbs. K_2O	68 lbs. K_2O
Total cost	$57.49	Total cost	$661.00
Total cost of commercial material	$16.00	Total cost of commercial materials	$621.00
Fertilizer used per acre of cleared land	61 lbs.	Fertilizer used per acre of cleared land	515 lbs.
Cost per cleared acre of land	$ .93	Cost per cleared acre of land	$ 10.67

Fig. 4. Well-fertilized dense pasture herbage including plenty of legumes is adding needed organic matter to many fields where topsoil has previously been lost through erosion.

has been supplied as demonstration material. Mr. Wilcox pays approximately one half the commercial price for the demonstration material he uses. Undoubtedly, the liberal use of fertilizer has assisted with the development of an intensive grassland program, bringing about a greatly increased farm output and providing greater efficiency in operation on this farm.

The Wilcox unit is not an unusual test demonstration farm but is typical of many others, not only in Washington County but in other eastern Tennessee counties. With these demonstration farms located in the various communities for other farmers to observe, this grassland program is becoming area-wide. Other farmers having observed the practical application of the liberal use of plant nutrients in developing a grassland program on the test demonstration farms are following a similar course. This entire area is fast going to grass, and utilizing it with more livestock.

Is it economically feasible not to grow the needed grain on these relatively small owner-operated farms? A number of the demonstration farmers will answer the question in this way: "If I grew my grain, I would have to use much of my limited acreage in a rotation, which would greatly reduce my pasture and hay acreage, thus reducing the volume of livestock my farm would carry. By improving my acres to where I can produce pasture and hay intensively, the additional livestock I can carry on acres that would otherwise be in corn or small grain will more than

(*Turn to page* 47)

Fig. 5. Steep hillsides of only fair native fertility, when properly fertilized, will produce pasture turf that will frequently net a return of more than $125 per acre.

Fertilizer Analyses Are on the Move—UPWARD

By Firman E. Bear

Soils Department, Rutgers University, New Brunswick, New Jersey

"DON'T make a move," says a mysterious deep bass voice over the radio, and one immediately feels a chill run down his spinal column. A few seconds later, when the voice continues "before calling Lincoln," he is greatly relieved to find that this is merely a transportation company's technique for keeping its moving vans on the go.

The easiest thing to do is to stay put. Never move. Do the same thing today you did yesterday and the day before, and look forward to more of the same tomorrow, next week, and next year. But, fortunately, there are a lot of dissatisfied folks who want things to be different. They not only keep on the move themselves but force the rest of us to move with them.

Take the fertilizer business, for example. It's a far cry from the old 1-8-1 analysis of 50 years ago to the modern 12-24-12. But nobody feels badly about this move. Everybody agrees that a farmer can get more pounds of plant food for $1 in a high-analysis mixture than he can in a low-analysis one. The only question that remains in anyone's mind is whether something of value was lost in the shift from low- to high-analysis fertilizers.

To raise percentages of nitrogen, phosphoric acid, and potash in fertilizers, extraneous elements must be removed. If a pound of urea replaces one of ammonium sulfate, the sulfate radical is dispensed with and more than twice as much nitrogen is supplied. Similarly, if double superphosphate replaces the ordinary grade, calcium sulfate is discarded. Crude potash salts are being refined to eliminate such impurities as the chlorides and sulfates of sodium, calcium, and magnesium.

The elements thus removed from the mixture have some value, but nobody knows just how much. If it is found that any of them are needed in any given case, they can usually be supplied in less costly forms. This is especially true of calcium and magnesium, which, as low-cost pulverized limestone, have added value as acid-neutralizing agents in soils. Where the rainfall fails to supply the necessary sulfur, relatively small amounts of ammonium sulfate, ordinary superphosphate, or gypsum can be added to the mixture. Low-analysis fertilizers may contain 5 to 10 times as much sulfur as required by the crop to which the fertilizer is applied.

Yet, the question still remained as to whether, by removing these and other non-credit constituents, something of special value had been lost from the fertilizer. So we decided to carry out an experiment to see just what happened to the soil as such, and to the crop growing on it, as the fertilizer concentration was raised to ever-higher levels.

Accordingly, in 1941, an experiment was set up on two soils, one a well-drained and highly-productive Sassafras loam and the other a poorly-drained Whippany silt clay loam. Representative lots of these soils, horizon by horizon, were placed in 3-foot-deep steel cylinders that had been buried in the earth to within 6 inches of their tops. These cylinders had diameters

of 23 inches. They were filled to the level of the soil outside them. The bottom layer of soil was in direct contact with a heavy C-horizon material derived from Penn shale, which underlies the area.

After the soils were in place, fertilizer was applied each spring for the next 10 years at the rate of 1 ton of 4-8-8, or its equivalent in some higher analysis of the same nutrient ratio, an acre annually. In one group of cylinders the pH values were adjusted to 6.0 and then maintained at approximately that level for the entire period by uniform applications of pulverized dolomitic limestone. In a second set of cylinders no limestone was applied, the soil pH levels being permitted to drop to whatever levels they would.

Comparison was made of the soil and crop effects of 4-8-8, 5-10-10, 6-12-12, 8-16-16, 10-20-20, and 12-24-24 analyses. The lower analyses contained Milorganite, sodium nitrate, ammonium sulfate, and ordinary superphosphate. For increasingly higher analyses, more and more use was made of urea and double superphosphate. The same 60 per cent grade of muriate of potash was used for all of these analyses. At the end of the 10-year period, the soils, to a 7-inch depth, were examined in detail to determine to what extent changes in pH values, cation exchange capacities, and exchange cation concentrations had occurred.

The 4-8-8 analysis left the soil in best condition, as measured by the criteria used. This was to be expected, since Milorganite is a dried activated sewage sludge containing 28 per cent ash. As the amounts of this material in the mixtures were reduced, soil pH values, exchange capacities, and exchange calcium tended to be lowered, and exchange hydrogen tended to be increased.

The general effects of the use of all these grades of fertilizer, when applied to the well-drained Sassafras loam, were to lower its pH value, increase its exchange hydrogen, reduce its exchange magnesium and calcium, and materially increase its exchange potassium. Data obtained on the Whippany silt clay loam, a soil that is very difficult to work and to sample, were not so consistent.

The crops grown during the course of the test were snap beans and carrots on the limed soil, and potatoes and carrots on the unlimed soil. Data on yields were recorded but, since the treatments were not replicated, conclusions concerning them are not very reliable. Yet there was nothing in the yield data of either the edible or inedible portions to indicate that any one of the fertilizer grades was dependably more effective in crop production than any other, either for the entire period or for the early or late years of the test.

Average cation summation values for the plant tops, calculated on the basis of m.e. in 100 grams dry tissue, were highest (308) for potatoes, intermediate (272) for snap beans, and lowest (242) for carrots. Potato tops were relatively high in magnesium and potassium and low in calcium. Snap bean tops were relatively high in calcium and magnesium. Carrots from soils with low pH values generally contained much more sodium than those from soils with high pH values. Tops of carrots receiving fertilizers containing sodium nitrate tended to be relatively high in sodium. Snap bean and carrot tops were low in sodium.

In general, there was little in the evidence to indicate any very serious consequences to the soil from increasing the concentration of the fertilizer. Significant effects from all grades were a lowering of pH values, an increase in exchange hydrogen, and a reduction in exchange magnesium and calcium, especially the latter. Fortunately, relatively inexpensive liming materials can be used as correctives to control pH and exchange hydrogen values and to overcome both magnesium and calcium deficiencies as they develop.

Even though two crops were grown and harvested each year, the contents of exchange potassium in both soils

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Potential of Fertilizer Use for More Efficient Production as Applied to the Midwest[1]

By K. C. Berger

Soils Department, University of Wisconsin, Madison, Wisconsin

LARGE population increases in the past 10 years and the prospects of a continuing rapid increase in the population are causing growing concern regarding the future adequacy of food supplies in this country. Great progress has been made in increasing crop production, and the increased crop is now produced with greater efficiency and with fewer people on our farms than ever before. This increased crop production is due mainly to the expansion in the use of commercial fertilizer, the increased technological information available on methods of fertilization, better control of insects and diseases, and increased mechanization on our farms.

The greatly increased usage of fertilizer together with the shortage of various fertilizer materials, particularly sulphur and nitrogen, has caused some concern among agricultural leaders. If a shortage of fertilizer materials becomes critical, it is important to know the effect of reduced fertilizer applications on the yields of the major fertilizer-using crops. If the need for food is greatly increased, as prospects are that it will be, it is also important to know how much the yields can be increased through additional applications of nitrogen, phosphate, or potash.

As a result of literally thousands of experiments this information was available, but scattered in individual states throughout the nation. The Fertilizer Work Group, organized under the National Soil and Fertilizer Research Committee, was charged with assembling and analyzing all of the available information on the fertilizer requirements for major fertilizer-using crops on different soils, and with furnishing federal agencies with the reports on fertilizer needs and the most effective use of available fertilizer supplies.

Method of Gathering Data

The United States was divided into four sections, namely: Northeastern, Southern, Western, and North Central. This report is primarily concerned with the North Central region consisting of the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas.

Two steps were involved in the compilation of the data of these reports. First, crops and soils specialists in each state prepared summaries of all published and unpublished fertilizer experiments, showing the response of each of the principal crops to N, P_2O_5, and K_2O. Second, state summary curves were prepared to fill in the gaps in the data, and these curves were prepared on the basis of experience, observation, and the combined judgment of the technical specialists involved. These state average responses for each crop were

[1]Contribution from the Department of Soils, University of Wisconsin, Madison, Wisconsin. Published with the permission of the Director of the Wisconsin Agricultural Experiment Station.

calculated as percentage increases or decreases from yields at current average use of the nutrient in question.

The benefits of lime are evaluated only for forage crops, although it is recognized that there are both direct and indirect benefits to other crops in the rotation. The data, given in the report, record the expected response of the crop being fertilized during the growing season. The residual effect of fertilizer, the effect of mixed cropping, or the year of crop sequence in a rotation was not evaluated, and the effects of fertilizer on crop quality and composition were not measured.

The picture presented by these reports is of necessity a generalized one, but at the same time gives considerable relatively specific information. The preliminary reports, one on a national basis and one for each of the four agricultural regions, were prepared in the fall of 1951 (2,3,4,5,6).[2]

Soil and Climatic Characteristics

The North Central region, commonly known as the breadbasket of America, produced in 1950, 75% of the corn; slightly over 54% of the wheat; 68% of the rye; 40% of the barley; 81% of the oats; 90% of the soybeans; and 47% of the hay grown in the United States.

Considerable variation exists in the climatic and soil conditions from one part of the North Central region to another. The eastern and southern parts of the North Central region receive more rainfall than do the northern and western portions. Rainfall varies from about 30 to 35 inches annually in the eastern and 35 to 40 inches in southern Missouri to less than 15 inches in the extreme northwestern portion.

In the eastern part of the region, soils have been farmed longer and are in the humid region where considerable leaching has taken place. In general, soils are more acid and lower in available plant-food elements in the eastern part than they are in the western part of the North Central region. In the western part of the region many of the soils are neutral to slightly alkaline in reaction and relatively high in available plant nutrients, particularly calcium, magnesium, and potassium. The northern soils are generally higher in organic matter than those in the southern portion of the region.

Types of farming also influence the present fertility status of the soil. Cash grain cropping and pasturing of livestock result in relatively smaller losses of potassium, calcium, and magnesium than does the dairy system where much of the forage is fed to animals as hay and silage and a considerable portion of the potassium and nitrogen is lost through improper handling of the manure. For these reasons larger amounts of fertilizer are used in the eastern part of the region where nitrogen and phosphate are particularly needed, probably to a greater extent than is potash; while in the northern parts of the region in the dairy sections, there is an increasing need for potassium. Generally greater responses for all crops on a regional basis can be obtained through the addition of relatively small amounts of nitrogen.

Past and Present Fertilizer Usage

It has been in the past decade only that the North Central region has become really fertilizer conscious as shown by the data in Table I (1). When fertilizer consumption in the United States is considered, the greatest percentage increase in fertilizer usage has occurred in the North Central region where in the past 10 years fertilizer usage has increased nearly threefold, with a total annual usage in 1951 of over four and one-half million tons. The Western region, still newer in fertilizer usage, increased its consumption of fertilizer about 230% up to a million and a quarter tons. The Southern region has been traditionally a heavy fertilizer user and while consumption has increased only 80% the total now used is nearly ten and one-half million tons. Fertilizer consumption in the northeastern region increased 31% in the same period.

[2] Figures in parentheses refer to "Literature Cited."

Fig. 1. Seventy-five per cent of the corn produced in the United States is grown in the North Central region.

The heavier fertilizer-using states in the North Central region are, of course, in the eastern portion where need for fertilizer is greatest and the land has been farmed longer. For the region as a whole, however, fertilizer usage on an average acre basis is relatively small. On the slightly over 225 million acres in the North Central region the average annual application of fertilizer is only 1.5 pounds of N, 6.8 P_2O_5, and 3.3 pounds of K_2O per acre. This, of course, in spite of the increased usage in the last 10 years, is a relatively low rate of the fertilizer application.

Data given in Table II show the fertilizer usage for the major fertilizer-using crops in the North Central region. On a regional basis, corn receives slightly more than the average fertilization, while hay, pasture, soybeans, sorghum, and flax receive less than average. Heaviest fertilized crops are tobacco, vegetables, and potatoes. Cotton, fruits, and beets, with relatively small acreages, also receive high amounts of fertilizers. Data given in the preliminary regional report (3) show that raising the application of nitrogen from 3 to 40 pounds per acre on corn would increase the yield 25%; on wheat, raising the application of 1.8 to 40 pounds would increase the yield 33%; with

TABLE I.—FERTILIZER CONSUMPTION IN THE UNITED STATES, 1941 AND 1951.

Region	Total consumption short tons		Increase in consumption	
	1941	1951	Short tons	%
North Central	1,219,501	4,633,934	3,414,433	280
Western	382,266	1,257,776	875,510	229
Southern	5,816,656	10,456,233	4,639,577	80
Northeastern	1,762,920	2,315,806	552,886	31

TABLE II.—ACRE USAGE OF N, P_2O_5, AND K_2O FOR THE MAJOR FERTILIZER-USING CROPS IN THE NORTH CENTRAL REGION. 1950.

Crop	Acres in region (1,000 acres)	Fertilizer usage, pounds per acre		
		N	P_2O_5	K_2O
Corn	52,804	3.0	8.4	5.8
Sorghum	1,910	0.7	0.8	0.2
Wheat	40,706	1.8	7.2	3.4
Rye	904	1.4	8.0	5.0
Barley	6,507	0.3	2.6	1.3
Oats	28,813	1.4	7.0	3.6
Soybeans	10,494	0.2	3.0	2.7
Cotton	445	13.0	13.0	17.8
Tobacco	30	43.4	118.0	144.3
Beets	354	7.0	36.6	24.4
Flaxseed	2,012	0.5	3.2	1.5
Potatoes	565	9.3	36.6	38.8
Vegetables	1,367	16.3	35.0	26.0
Fruits	798	17.7	19.0	17.8
Hay	27,704	0.3	7.4	1.3
Pasture	50,178	0.2	4.4	0.7
All crops	225,591	1.5	6.8	3.3

rye, the average annual application of 40 pounds of nitrogen would increase the yield 46%; on oats, 41%; while with potatoes, yields would be increased 38% and pasture 62%. Greatest response to phosphate would be obtained from flaxseed where the average annual acreage application of 40 pounds of P_2O_5 would increase the yield 26%, on barley 22%, on rye 48%, and on corn 12%.

Increasing applications of potash to 40 pounds per acre from the current

(*Turn to page* 46)

Fig. 2. Potato yields and quality can be greatly increased by proper fertilization.

Fig. 1. Everyone is happy when the crop is like this.

Oregon Can Produce More Strawberries

By R. Ralph Clark

Horticulture Department, Oregon State College, Corvallis, Oregon

MANY of Oregon's strawberry growers are harvesting good yields of berries from their plantings. This was shown quite plainly by the survey made following harvest when 90 growers in the commercial producing areas were interviewed.

Why some growers produce so many berries per acre and others so few, was the question for which no one had a satisfactory answer. Everybody had ideas, but we all needed sound advice. This was the reason for making a survey. We must bring up our State-wide average from its present level of 1.6 to 1.8 tons per acre if growers are to stay in business and make a profit. This production is not enough to meet the expense if all costs are figured as they should be. It means that some growers are losing money because so many have yields of three or more tons per acre.

The survey sheet used asked more than 100 questions which covered nearly everything from the grower's name to the tonnage of the finished product. We wanted to know the what-where-when-how-and-why of everything connected with the production of this crop. It was felt that possibly some of the so-called little things had significance in this field of strawberry production. These have come to light as the reports were analyzed. As the statistical analysis proceeded, it was found that some questions brought out nothing of significance, and they were

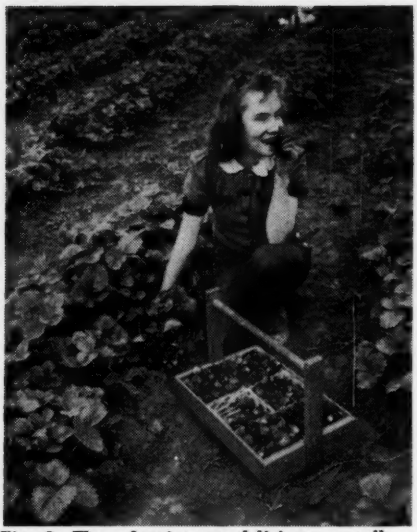

Fig. 2. These berries are delicious as well as plentiful.

dropped in order to save time and expense.

The 90 growers interviewed grew berries in the nine leading producing counties of Oregon. They had 1,327 acres in production last year, which makes an average of over 14 acres per grower. These producers had a combined experience in strawberry culture of 976 years or nearly 11 years per grower. The average production per acre was 3.9 tons. This probably would indicate that only high producers were selected for the survey, which was not the case except that we endeavored to see all of the Five-ton Club members. It was only possible to get reports from 16 of these members and so the remaining 74 were taken at random. The only requirement was that the fields could be seen from the road and had been cared for so the condition of the plants could be observed. Many fields that looked good in August and September had only returned 1 to 1.5 tons per acre. The why of this was quite apparent as the questions were answered. Names of the growers were taken only so that cooperators will be sure to receive a copy of the complete analysis when it is finished.

The 75 Marshall growers interviewed had an average production of 3.6 tons per acre. Seven growers of the Northwest variety were interviewed and they had an average production of 6.3 tons. This average tonnage would be too high for all growers of this variety because four of these seven were members of the Five-ton Club and all but one were growers with rather outstanding records for production. Many growers of this variety were not as successful. Growers with more than one variety, of which there were eight in the survey, had an average production of 3.8 tons per acre. Here again we had Five-ton Club members and others who were outstanding in their results rather than the average grower. Many growers of mixed varieties had low returns due to the prevalence of a severe virus infection.

The following tables give the factors, breakdown, and results obtained:

Soil Type	Number of growers	Tons/A			
		All varieties	Marshall	Northwest	Mixed
Olympic	29	3.1	3.1	.....	.....
Powell	10	3.9	3.9	.....	.....
Willamette	19	4.7	4.5	7.0	4.0
Hillsboro and Newberg	4	5.2	4.5	7.8	4.3
Chehalis	10	3.7	3.0	5.3	.....
Melbourne	7	3.1	3.1	.....	.....
Amity	3	5.0	.....	6.0	4.5
Parkdale loam	6	4.0	4.0	.....	.....
Others	2	4.5	4.0	5.0	.....

The years of experience a grower has had seems to make some difference, but in the reverse to the usual way of thinking. Possibly new growers were more particular as to the land used for strawberry production.

Experience	Number of growers	Tons/A (All varieties)
1–10 years	52	4.1 tons
11–20 years	23	3.6 tons
over 20 years	15	3.4 tons

How long the land had been in use was an interesting factor showing both new and old land producing the highest yields. This might indicate that we depend too long on a new piece of land before we do anything to improve it or restore its productivity.

Age of land	Number of growers	Tons/A (All varieties)
1–3 years	12	3.8
4–10 years	4	3.5
over 10 years	74	3.9

There are several reasons why old strawberry land will not produce as well as new soil. The build-up of diseases in the soil probably is most important, but possibly some elements are removed which have not been replaced. Organic matter also becomes depleted.

Strawberries before?	Number of growers	Tons/A (All varieties)
Yes	22	3.0
No	68	4.1

Soil handling practices were especially interesting since strawberries are raised on soils handled in many different ways.

Soil handling	Number of growers	Tons/A			
		All varieties	Marshall	Northwest	Mixed
New	5	4.2	4.2	.....	.....
Cover Crop	35	3.3	3.2	6.0	2.5
Grain	18	3.7	3.3	6.0	4.5
Grass Sod	7	3.9	3.8	.....	.....
Clover Sod	6	4.5	4.6	4.0	.....
Vegetables	14	4.6	4.4	7.0	3.5
Old Orchard	5	5.0	3.7	7.0	.....

The application of nitrogen fertilizers showed that if land needed fertilizer it needed a rather liberal amount. Where no fertilizer was used, the soil evidently was well built up before planting.

Fig. 3. With proper fertility there are few cull berries.

Actual N.	Number of growers	Tons/A (All varieties)
0	9	4.9
1–40 lbs.	32	3.8
41–80 lbs.	36	3.6
over 80 lbs.	13	4.0

Results from use of phosphate followed somewhat the same pattern as for nitrogen.

Actual P_2O_5	Number of growers	Tons/A (All varieties)
0	5	4.8
1–100 lbs.	24	3.1
over 100 lbs.	36	3.9
Heavy application at planting time	25	4.3

The use of potash up to about 100 pounds per acre actual K_2O showed an over-all increase in production with some amazing yield differences in fields where it was a limiting factor. Sometimes this increase was 100% on Chehalis soil or where there was a definite need for this kind of fertilizer. Where

no potash was used or light applications were made, rot was often a loss factor. Many of our good strawberry-producing soils apparently are low in potash unless it is applied in fairly heavy applications. This could be the cause of heavy losses due to soft berries.

Potash (K_2O)	Number of growers	Tons/A (All varieties)
0	30	3.8
1–50 lbs.	21	3.9
51–100 lbs.	26	4.1
over 100 lbs.	13	3.5

Irrigation showed up well.

Irrigation	Number of growers	Tons/A			
		All varieties	Marshall	Northwest	Mixed
Yes	51	4.6	4.0	6.3	4.0
No	39	2.9	2.9	.....	3.3

Certification of plants is now carried only on the Marshall variety. These plants showed up well even though all non-certified stock had come from certified stock the year previous.

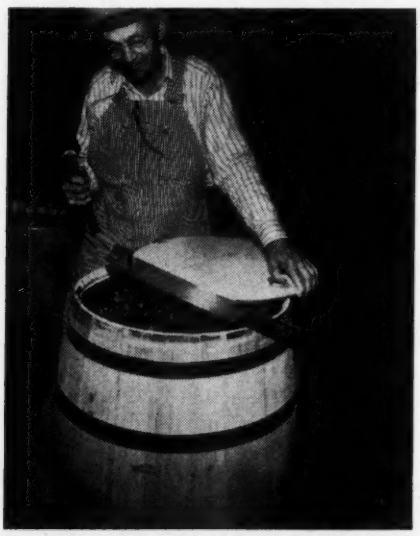

Fig. 4. If the culture is right, there will be more barrels of berries.

Certified stock	Number of growers	Tons/A (Marshalls)
Yes	61	3.7
No	14	2.7

The figures on plants obtained from different places were interesting, but since only a very few of the plantings were made from Washington and California stocks, the results are not of significance in those cases.

Source of stock	Number of growers	Tons/A (Marshalls)
Eastern Oregon	28	3.7
Western Oregon	14	3.8
Mixed Source	24	3.4

These figures bring out two things. First the equality in production of Oregon certified stocks and then the loss due to having plants from several sources on the same farm. The combining of otherwise mild viruses may cause a severe breakdown of stock and loss in production.

Strawberry plants hand set by 30 growers averaged 4 tons while those set by machine on 60 farms yielded 3.8 tons per acre.

Plants set in April yielded 3.7 tons per acre while those set in May produced 4.1 tons. This might show that some plants are set in soil before it is in a proper condition. This point is very important.

Does it pay to plant more plants per acre or set in runner plants? See following table for answer.

Distance apart	Number of growers	Tons/A
14″	15	5.0
15–24″	36	3.9
25–44″	51	3.7

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The Changing Fertility of New England Soils[1]

By C. L. W. Swanson

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NEW ENGLAND represents an area longer in cultivation than any area in the United States. More data on fertilizer usage and the effect fertilizers and cropping have had on the fertility of the land are available here than anywhere else in this country. A broad regional study of the lines of evidence which indicate fertility trends in New England soils has been made possible by the collaboration of soil scientists in the New England Agricultural Experiment Stations and the U. S. Department of Agriculture.

Summarizing the facts will show the trend of soil fertility changes and also point up research deficiencies and new needs providing the basis for initiating new research. These data also should prove helpful in the interpretation of soil research data in other areas.

Maintaining and improving the fertility level of our soils constitute one of the most important problems facing the United States in this century, or the next, or the next. The soils of this country have produced food and clothes for a rapidly growing population for only a couple of hundred or so years. They must continue to produce at even higher rates for a continuing increasing population. The loss of soil fertility eventually means the loss of agricultural production—the loss of food and fibre. Nations and civilizations have faded and died because they ignored or did not know how to maintain the productive capacity of their soils.

Historic New England

New England is better known for the great men it has produced like Paul Revere, Noah Webster, John Greenleaf Whittier, Calvin Coolidge, the Cabots and the Lodges than it is for its agriculture. People associate New England with Plymouth Rock, the Revolutionary War with its historic North Church and Bunker's Hill, Harvard, Yale, Brown, and other great older universities, and the quaint New England towns and scenic countryside. Everyone knows about thrifty New England and its Yankee ingenuity.

To many, New England means the extreme northeastern part of the United States—a part of the 13 original states —largely forested, highly industrialized, and having little agriculture. Actually, New England covers an area only about as large as Missouri.

Is agriculture then, in New England important? Has there been enough farming in the past in New England to warrant a study of the changing fertility of its soils?

An Intensive Agriculture

The importance of agriculture in New England, as well as its intensiveness, is shown by economic data. The 1950 census shows income per acre for land in farms for New England at $42.38 compared with $27.73 for Iowa and $17.96 for South Carolina. Connecticut led New England with $95.31, an increase over 1944 of 70 per cent,

[1] Presented before Section O (Agriculture), American Association for the Advancement of Science, Boston, Massachusetts, December 28, 1953. Material for this paper has been extracted in part from a report of the New England Soil Fertility Subcommittee of the Northeastern Soil Research Committee.

Fig. 1. Growing shade tobacco under cheesecloth tents in the Connecticut Valley. Selected leaves are used for the outer wrapper in cigars.

compared with 43 and 3 per cent for Iowa and South Carolina, respectively.

Agriculture was dominant in New England in the early history of our country. It became relatively less important after about 1870 with the development of agriculture on fertile soils in other sections of the country. But agriculture in New England is still important today—important to New England and to the national economy. True, New England's agriculture is not extensive, rather it is intensive. It is because of its intensiveness that agriculture in New England is important. This intensive farming of the soils is reflected in their fertility status now.

Although land in crops has decreased, population has increased, making New England deficient in food and feed. Both are shipped in from the west.

A modern renaissance of intensive agriculture is now taking place in New England. Idle land and land in trees suitable for crops are being cleared and put to the plow. "Greener Pastures" is the slogan used by one group of farmers to encourage production of more feed for their livestock, and hence, more food for New England's 10 million people.

But still more land could be put into production and still more food produced. From 10 to 15 per cent more land now idle or in forest could be farmed if every soil were used according to its capabilities. Changes in land use, however, must be made. Land suitable for farming must be cleared of forest and field stones, wet areas now partially farmed or in forest must be drained to make them more productive, and widespread use made of improved methods of soil management and crop production.

Specialized High Value Crops

The 1950 Census shows that three of the five leading states in value per acre of crops harvested are in New England. The five leading states and the average value per acre for each are: Connecticut —$201.53, Rhode Island—$179.40, Florida—$178.56, Arizona—$172.35, and Massachusetts—$169.06.

An examination of the principal crops grown shows that the relatively high value per acre is due primarily to the types of crops grown. Crops with high values per acre, such as tobacco, vegetables, fruits, and horticultural special-

Fig. 2. Potato harvesting in Aroostook County, Maine.—*Courtesy Maine Agricultural Experiment Station.*

ties (Figures 1, 2, 3, and 4), constitute a higher proportion of all crops harvested for these states than elsewhere.

Predominantly agricultural areas occur in the potato area of Aroostook County in Maine (Figure 2), the dairy farming district of the Champlain Valley (Figure 5) and in Litchfield County, Connecticut, the general farming areas of the southern counties of Rhode Island and in western New Hampshire, eastern Connecticut, and western Massachusetts, and the tobacco region of the Connecticut Valley (Figure 1).

Local specialized farming occurs, such as blueberry farming in the coastal region in Maine, the cranberry industry (Figure 4) in Plymouth and Barnstable counties, Massachusetts, (which pro-

Fig. 3. Growing McIntosh apples in Connecticut.

duce almost two thirds of the crop in the United States), and specialized vegetable production near the larger centers of population. Poultry farms are scattered everywhere, and apple (Figure 3) and peach farms are found principally in the eastern half of New England where climatically adapted.

Seventy-seven per cent of the soils in New England are covered by forest. It is this tree cover that makes the traveler think that New England has only a little agriculture.

According to census data, an average of about 85 per cent of the harvested cropland in New England is in hay. Plowable pasture and hay combined comprise 83 per cent of the agricultural land. The plowable pasture acreage includes permanent pasture, except woodland pasture, which is included in the forest acreage. The agricultural land on which row crops are grown occupies 13 per cent of the total land area outside of cities and villages.

Cropping Fits Soil Pattern

The relationship between soil association patterns and types of farming areas in New England is clearly evident. The tobacco growing area in Connecticut and Massachusetts (Figure 1) corresponds with the Enfield-Agawam-Merrimac soil association. The soils in the potato growing area in Aroostook County, Maine (Figure 2), consist principally of the Caribou-Perham-Washburn association. Nonagricultural areas are limited principally to soil associations with hilly to mountainous terrain. The finer-textured soils in the western part of New England are used chiefly for dairying (Figure 5). The coarser-textured soils in the eastern section bordering the Atlantic coast line support poultry, truck, small scale dairying, and mixed farming.

Podzols and Brown Podzolic are the major upland great soil groups (Figure 6). It is likely that in Massachusetts, Connecticut, and Rhode Island most of the cropping is on Brown Podzolic soils and in Maine, New Hampshire, and Vermont on Podzols and some Brown Podzolic soils. Climatically, Massachusetts, Connecticut, and Rhode Island are warmer and have longer growing seasons than the states farther north where Podzols predominate. Generally, the soils in southern New England are farmed more intensively than those in northern New England. This is de-

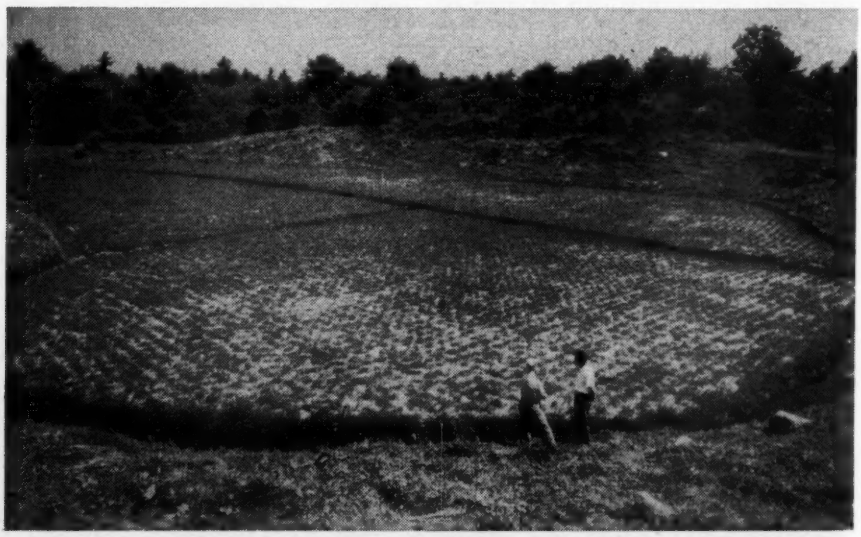


Fig. 4. Cranberry bog in Plymouth County, Massachusetts. Construction of bog may cost up to $4,000 per acre. Yield may be 25 barrels of cranberries.—*Courtesy A. B. Beaumont, Soil Conservation Service.*

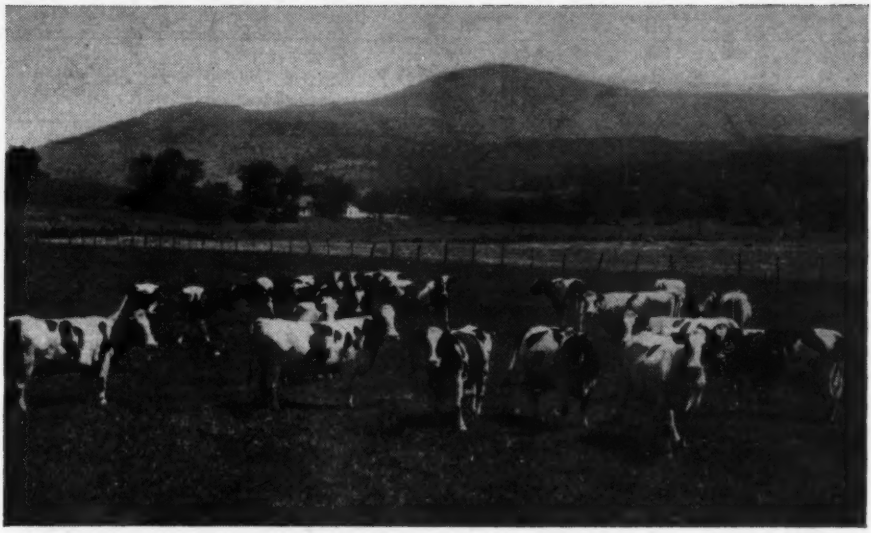


Fig. 5. Typical dairy scene in Vermont.—*Courtesy Vermont Extension Service.*

picted by the average income per acre for land in farms for northern New England of $27.49 and of $87.30 for southern New England (1950 Census).

Basically, the soils of New England are naturally low in fertility, high in acidity, generally of illite-type clays, generally sandy textured (fine sandy loam to sandy loam), responsive to fertilization, and generally have little erosion (except in areas intensively farmed). This compares, for example, with midwest soils (Figure 6) which are naturally fertile, low in acidity, montmorillonite-type clays, generally fine-textured (loams to silt loams), medium response to fertilization, and generally moderately eroded (many areas severely eroded).

Highly Responsive to Fertilizers

Although the soils in New England are naturally infertile, they are highly responsive to fertilization. If they are managed properly, including the use of fertilizers, they are very productive. Because of this, and for other reasons, they are especially suitable for the growing of intensive crops like tobacco, potatoes, and vegetables. For example, as much as 200 pounds of nitrogen, 120 pounds of phosphoric oxide, and 200 pounds of potash per acre are applied annually to shade-grown tobacco in the Connecticut Valley (Figure 1).

Comparison of the rate of application of fertilizer used per cultivated acre in New England with that in other areas in the United States is given in Table I. New England is third highest in the use of nitrogen, second in phosphoric oxide, and leads the Nation in the use of potash. Large acreages of two high potash-requiring crops, tobacco and potatoes, account for New England's high use of potash. That it does not use more nitrogen may be attributed to the fact that a large part of the land is used for dairying and little nitrogen is applied to pastures.

More fertilizer is used for potatoes than for any other crop grown in New England (Table II). Vegetables, tobacco, and corn are the next most heavily fertilized crops. The ratios of N, P_2O_5, and K_2O in the fertilizers used coincide closely with rates like 6-9-12 for Maine potatoes, 5-8-7 for vegetables, and 6-3-6 for tobacco. It is apparent that the greatest potential for increased fertilizer use is on hay and pasture.

TABLE I.—COMPARISON OF FERTILIZER USE BY REGIONS[1] IN THE UNITED STATES

Region	Nitrogen	Phosphoric oxide	Potash	Lime	Planted area
	lbs/A	*lbs/A*	*lbs/A*	*lbs/A*	*acres*
New England	7	15	13	95	6,599,000
Northeast	8	20	13	251	32,800,000
North Central	2	8	4	419	230,823,700
Southern	4	9	4	52	255,726,400
Western	10	6	8	(2)	41,817,300
United States	4	9	5	192	516,167,400

[1] Current use in 1949, National Soil and Fertilizer Research Committee.
[2] No data available.

Maine, in the past 15 years, has used fertilizers containing on the average more K_2O than P_2O_5. It is the only state in the country where this is true. This is related to the high potato acreage in Aroostook County. The trend throughout the region has been toward the use of more potash in proportion to nitrogen and phosphoric oxide.

Vermont uses relatively more P_2O_5 than the other states in this region. Predominance of dairying and relatively high applications of P_2O_5 to pastures account for this.

The predominantly sandy texture of the soils means that they warm up early in the spring. The predominantly single-grained structure allows for good aeration and rapid oxidation of organic materials which is conducive to making nutrients quickly available to plants. Because of the looseness of these soils, supplemental applications of nitrogen must be made to replace that leached from the soil. These soils can be worked soon after rains because of their sandy texture.

The unusual ability of soils in New England to tie up phosphates applied as fertilizers has resulted in many of the soils becoming higher in phosphates than they were before cropping, especially where heavily fertilized crops like tobacco, potatoes, and vegetables have been grown.

Serious Erosion Limited

Loss of soil from erosion is not the problem in New England that it is in some other parts of the United States. The Soil Conservation Service erosion map of the United States shows only local areas of moderate erosion in inten-

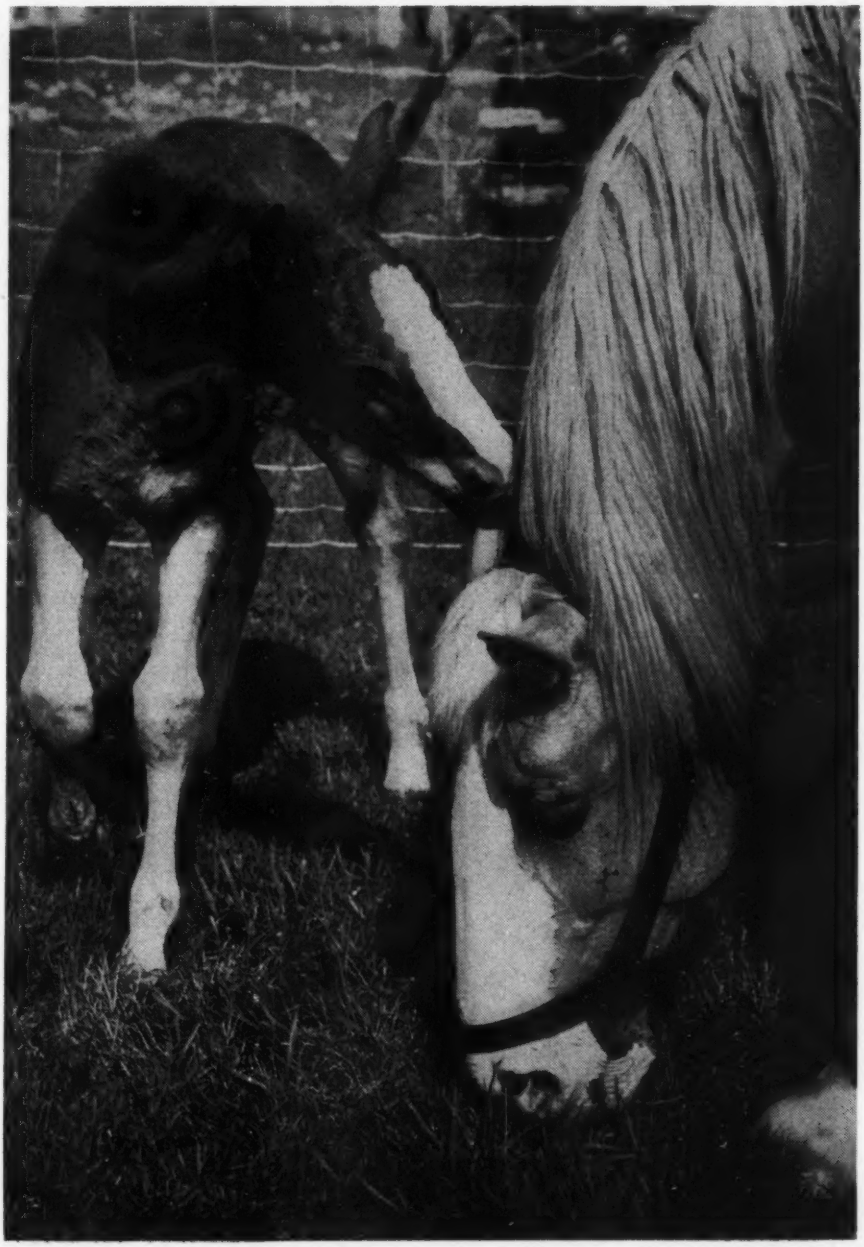
(*Turn to page* 41)

TABLE II.—PLANT NUTRIENTS APPLIED AS FERTILIZERS TO CROPS IN NEW ENGLAND DURING YEAR ENDED JUNE 30, 1950[1]

Crop	Total Area	N	P_2O_5	K_2O	CaO Equivalent
	1,000 acres	*tons*	*tons*	*tons*	*tons*
Corn	179	1,050	2,873	1,347	.....
Small grains	208	844	2,347	1,357	.....
Potatoes	162	8,947	16,421	20,856	.....
Vegetables	146	5,390	7,169	7,225	.....
Fruits	113	1,404	751	659	.....
Tobacco	27	2,720	1,410	2,720	.....
Hay	2,326	2,183	12,196	5,843	141,413
Pasture	3,438	1,248	7,818	4,074	34,464
Total	6,599	23,786	50,985	44,081	175,877

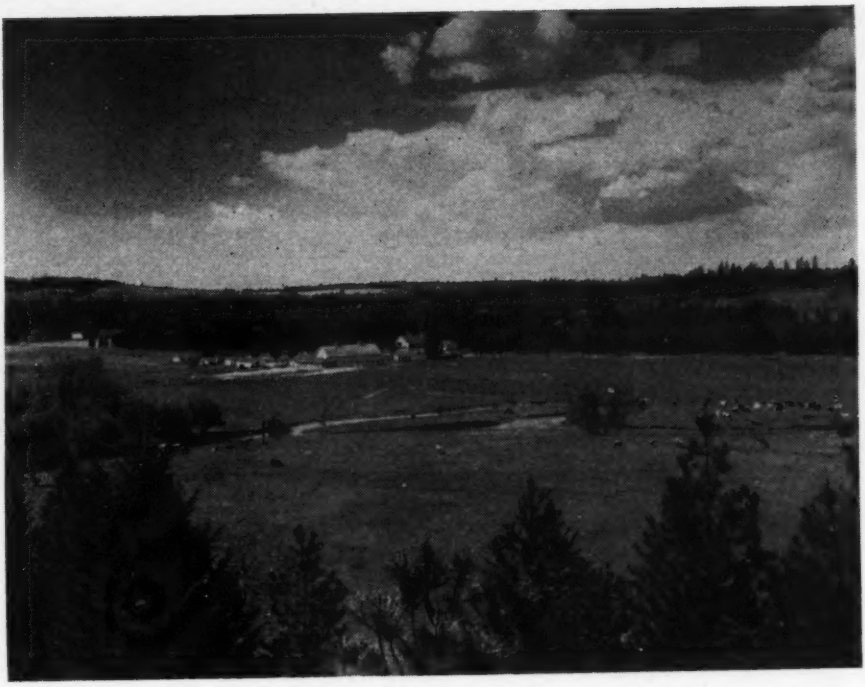
[1] National Soil and Fertilizer Research Committee.

PICTORIAL

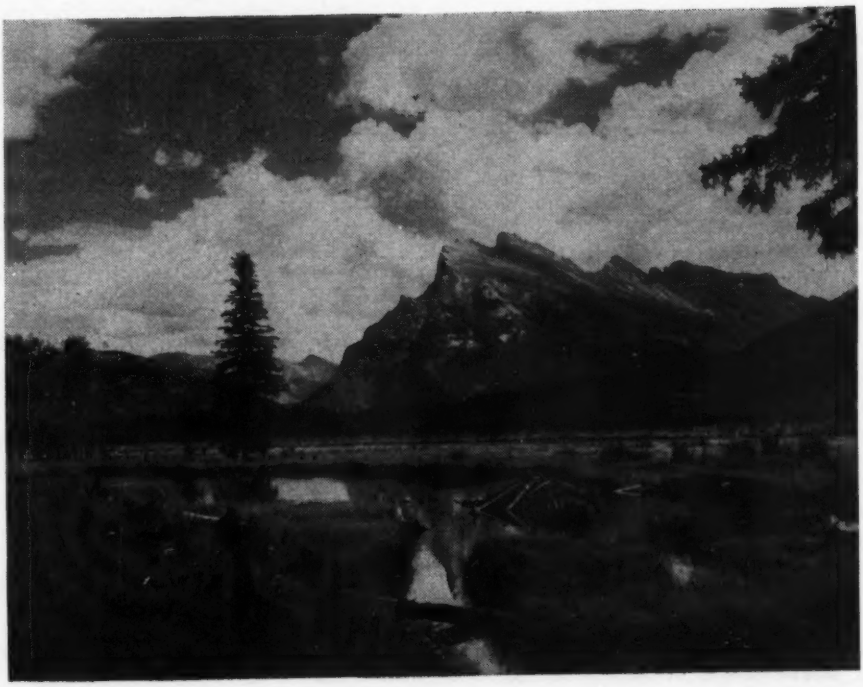


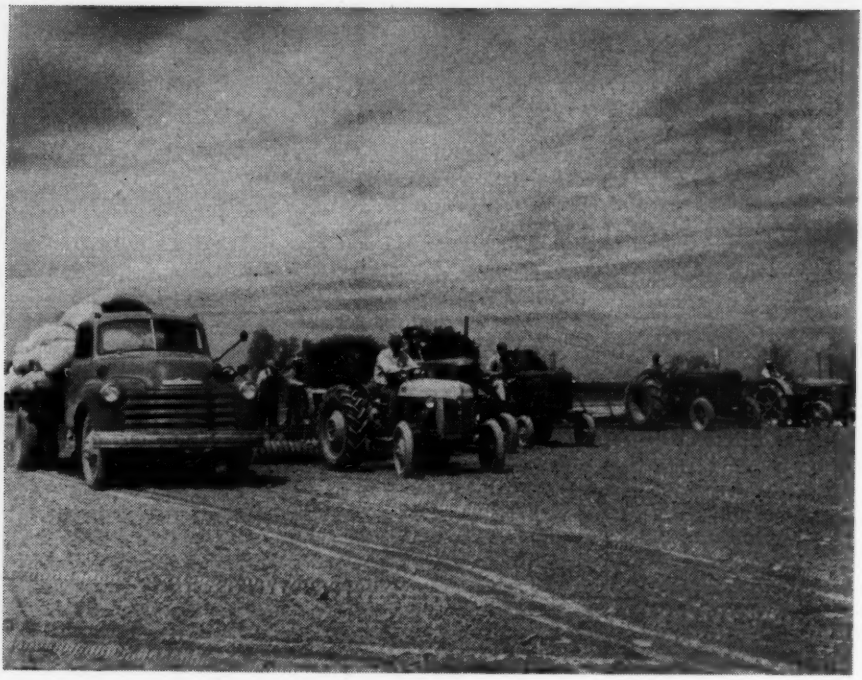
Teasing Mother!

In Prairie Country



The Great Northwest





Fertilize and Plant

The Editors Talk

Our Cover Picture

The strawberry, most widely adapted of the small fruits, is grown in every state in the United States. Principal producing centers are located in regions east of the Mississippi River and on the Pacific Coast. In 1953 the crop was worth 10 million dollars to the State of Washington, alone. More than 19,000 tons of the delicious berry were produced from 10,800 acres, most of which lies in the three most northwestern counties in the United States. Although the average production was not quite two tons per acre, there were many growers who went over the five-ton mark and a few who went as high as eight tons.

Most of this crop, for which the growers were paid 16 cents a pound, went into the frozen food pack. The Pacific Northwest with its long summer days and cool nights is noted for the quality of its berries. The predominant strawberry variety is still the Marshall, but it is slowly giving way to a newcomer, the Northwest, of equal quality but higher yielding.

The lower half of our cover illustration this month is from the file of Dr. Folke Johnson and Dr. Leo Campbell of the Western Washington Experiment Station at Puyallup. The leaves, petioles, and whole plants on the left are normal, while those on the right show extreme potassium deficiency symptoms. The symptoms were verified first by foliar analysis and then by response to muriate of potash in the field. The laboratory analyses of the plant tissue showed the following:

	Per Cent K	
	Normal	Deficient
Leaves	0.84	0.44
Petioles	1.65	0.31

Strawberry plants exhibit definite symptoms of potassium deficiency by the development of marginal leaf scorch. This scorching may be distinguished from the firing, or marginal necrosis, caused by nitrogen deficiency in that the latter is produced first on old leaves and is always preceded by pronounced yellowing and reddening. Scorch due to potassium deficiency, on the other hand, usually develops first on mature leaves of intermediate age and may not be confined to margins. The potash deficiency symptom is characterized in its early stages by a purple discoloration on the edges of the leaves. As the lack of potassium continues to affect the normal functioning of the plant, this discoloration goes into a scorch. Scorched leaves may have a fairly normal green color except for the areas of dead tissue, or they may show more or less purple-red pigmentation. Leaves toward the base of the plant are the first to show the deficiency symptoms and the first to be sacrificed by the plant as it reserves its potassium supply for the growing tips in an effort to survive.

The fertilizer program of the successful strawberry grower in Washington will vary from soil to soil. Almost all of the growers in the five-ton-or-better class will use an initial massive application of from 500 to 700 pounds of treble

phosphate or 1,200 to 1,700 pounds if superphosphate per acre, good for the life of the planting. This material is placed in two bands, 4 inches down in the soil, about 7 inches apart before planting. The young plants are then set between these bands. Up to 30 pounds of actual nitrogen are sidedressed each of the following years of the life of the planting. The potash requirement is met by applying 100 pounds of muriate of potash per acre annually, sidedressed as with the nitrogen.

The Road to Fertility

"Prophets of doom long have found agriculture a fertile subject about which to espouse their gloom and pessimism regarding the future. Use and abuse of the land by succeeding generations of farmers foretells of starvation to come for the world's masses, is the essence of their unhappy song. Such ideas, of course, fail to take into account the phenomenal progress and development of scientific farming in this country during the last half century, as well as its promising future. Also, such ideas often are based on the premise that the earth's soil was at maximum productivity in its natural state and has been leached and robbed of its life-giving powers by succeeding generations of farmers.

"Actually, as regards the latter, the opposite is true in some cases, at least, where modern farming methods and techniques have turned unproductive seedbeds into highly fertile acres. Such has been the case on the northeastern seaboard of this country, according to a soil scientist at the Connecticut Experiment Station, who points out that the farm land of New England, which was not naturally fertile when the Pilgrims landed, has been made highly productive by proper farming methods, and is growing more productive all the time.

"Virgin soil under a long-established forest is not always good, he says. Often it has a thin top layer of humus covering a soil zone from which nearly all plant food has been leached by water percolating from the surface. When the settlers cleared New England forests 300 years ago, they found the fertile top soil only two or three inches deep. Below this was sterile subsoil, and when the plow mixed the two together, the blend was low in nearly everything that plants need for survival. It was not the lavish virgin soil of popular fancy, and farming was extremely difficult.

"But today the picture is completely changed. Proper livestock farming and scientific farming, including proper crop selection, use of fertilizers and cover crops, have brought about a thriving agriculture that grows high-value crops on 'man-made' soil. Potato farms in Maine produce 4½ times as much per acre as they did 80 years ago. The 1950 census showed that Connecticut led all states in income per acre of farm land with $95.31. By way of comparison, Iowa was listed at $27.23 and South Carolina at $17.96.

"This is hardly a picture of a sick, decaying agriculture in the hands of reckless, irresponsible men. There is ample evidence today that other facets of the agricultural picture have failed to keep step with the good farmer's ability to produce and care for the land." . . .

From Vol. 31, No. 1, The Agricultural Situation, Published by The Corn Belt Farm Dailies.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.1	163.0	304.0	166.0	211.0	19.50	69.30	....
1952.....	36.9	50.0	196.0	331.0	157.0	209.0	21.05	70.00	....
1953									
May.....	31.73	51.5	115.0	413.0	149.0	206.0	17.95	61.80	....
June.....	31.51	51.0	102.0	398.0	146.9	188.0	16.05	61.20	....
July.....	31.87	51.2	95.5	402.0	147.0	187.0	15.45	59.00	....
August.....	32.77	51.3	91.4	350.0	148.0	186.0	15.85	56.70	....
September...	33.09	57.6	98.9	264.0	150.0	192.0	16.15	51.50	....
October.....	32.46	52.6	89.7	233.0	134.0	194.0	16.45	52.40	....
November...	31.82	42.3	83.4	232.0	133.0	200.0	17.25	53.40	....
December....	30.73	49.2	69.9	246.0	141.0	201.0	18.25	53.00	....
1954									
January.....	30.05	48.3	69.1	253.0	142.0	203.0	19.05	52.00	....
February.....	30.42	31.9	65.3	258.0	143.0	206.0	18.95	51.40	....
March.....	31.05	27.3	53.2	252.0	144.0	209.0	18.35	50.50	....
April.....	31.57	....	70.2	268.0	145.0	206.0	18.05	50.80	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1928.....	145	200	76	134	131	113	95	152	147
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	128
1931.....	46	82	66	83	50	44	73	40	107
1932.....	52	105	55	62	50	43	52	46	100
1933.....	82	130	118	79	81	84	68	57	90
1934.....	100	213	64	91	127	96	111	146	94
1935.....	90	184	85	80	102	94	63	135	116
1936.....	100	236	164	106	163	116	94	148	108
1937.....	68	204	76	89	81	109	74	87	114
1938.....	69	196	80	79	76	64	57	97	96
1939.....	73	154	100	84	88	78	67	94	98
1940.....	80	160	78	97	96	77	64	96	122
1941.....	137	264	116	105	117	107	82	211	138
1942.....	153	369	168	134	143	124	91	202	178
1943.....	160	405	188	235	174	154	125	231	270
1944.....	167	420	214	216	170	160	139	234	236
1945.....	181	366	205	232	198	170	127	227	240
1946.....	263	382	178	248	212	209	141	319	217
1947.....	257	380	232	248	336	259	148	381	262
1948.....	245	482	222	253	201	226	155	298	253
1949.....	231	459	184	244	193	213	139	192	232
1950.....	323	517	132	197	238	226	141	384	211
1951.....	306	512	233	346	259	239	164	307	269
1952.....	298	500	281	377	245	236	177	310	274
1953									
May.....	256	515	165	470	232	233	151	274	182
June.....	254	510	146	453	227	213	138	271	270
July.....	257	512	137	458	229	212	130	262	216
August.....	264	513	131	399	231	210	134	251	221
September...	267	576	142	301	234	217	136	228	159
October.....	262	526	129	265	209	219	139	232	175
November...	257	423	120	264	207	226	145	237	186
December....	248	492	100	280	220	227	154	235	224
1954									
January.....	242	483	99	288	221	230	160	231	271
February....	245	319	94	294	223	233	160	228	233
March.....	250	273	76	287	224	236	155	224	246
April.....	255	...	101	305	226	233	152	225	225

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports [2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports [2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952	.849	3.98	5.47	.401	.793	15.25	.200
1953							
May	.860	4.28	....	.430	.827	16.00	.210
June	.860	4.28	....	.361	.708	13.44	.176
July	.895	4.28	....	.396	.768	14.72	.193
August	.895	....	.. .	.396	.768	14.72	.193
September	.895	....	....	.396	.768	14.72	.193
October	.895	....	....	.396	.768	14.72	.193
November	.895	....	....	.396	.768	14.72	.193
December	.895	....	....	.430	.827	16.00	.210
1954							
January	.895	....	....	.430	.827	16.00	.210
February	.895	....	....	.430	.827	16.00	.210
March	.895	....	....	.430	.827	16.00	.210
April	.895	....	....	.430	.827	16.00	.210
	Index Numbers (1910-14 = 100)						
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952	158	110	112	72	83	63	83
1953							
May	160	119	...	76	87	66	85
June	160	119	...	66	74	56	80
July	167	119	...	71	81	61	82
August	167	...	...	71	81	61	82
September	167	...	...	71	81	61	82
October	167	...	...	71	81	61	82
November	167	...	...	71	81	61	82
December	167	...	...	76	87	66	85
1954							
January	167	...	...	76	87	66	85
February	167	...	...	76	87	66	85
March	167	...	...	76	87	66	85
April	167	...	...	76	87	66	85

Wholesale Prices of Ammoniates **

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952	3.34	2.09	13.95	11.27	9.72	9.16
1953						
May	3.34	2.28	10.34	11.24	6.23	6.14
June	3.34	2.28	10.61	11.26	6.62	6.31
July	3.34	2.28	10.34	11.15	6.75	6.14
August	3.34	2.28	10.14	10.95	7.53	6.68
September	3.09	2.28	9.82	11.04	7.51	6.91
October	3.09	2.25	9.73	11.24	7.96	7.75
November	3.09	2.22	9.61	11.24	8.19	8.19
December	3.09	2.22	10.96	11.24	8.50	9.03
1954						
January	3.09	2.22	11.28	11.24	9.26	9.71
February	3.09	2.22	11.20	11.45	9.34	10.02
March	3.09	2.22	11.35	11.70	9.59	10.20
April	3.09	2.22	11.63	12.15	10.32	10.55
	Index Numbers (1910-14 = 100)					
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952	125	74	399	319	288	260
1953						
May	125	80	295	318	185	174
June	125	80	303	319	196	179
July	125	80	295	316	200	174
August	125	80	290	310	223	190
September	115	80	281	313	223	196
October	115	79	278	318	236	220
November	115	78	275	318	243	233
December	115	78	313	318	252	257
1954						
January	115	78	322	318	275	276
February	115	78	320	324	277	285
March	115	78	324	331	285	290
April	115	78	332	344	306	300

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and all Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1928.....	148	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	130	127	86	56	130	102	77
1942.....	159	149	144	93	57	161	112	77
1943.....	193	165	151	94	57	160	117	77
1944.....	197	174	152	96	57	174	120	76
1945.....	207	180	154	97	57	175	121	76
1946.....	236	197	177	107	62	240	125	75
1947.....	276	231	222	130	74	362	139	72
1948.....	287	250	241	134	89	314	143	70
1949.....	250	240	226	137	99	319	144	70
1950.....	258	246	232	132	89	314	142	72
1951.....	302	271	258	139	93	331	152	76
1952.....	288	273	251	144	98	333	158	76
1953								
May.....	261	264	247	137	102	245	160	80
June.....	259	260	246	135	102	253	160	70
July.....	259	261	248	138	102	252	167	75
August....	258	262	249	139	102	261	167	75
September.	256	259	249	137	97	258	167	75
October...	250	258	248	137	96	265	167	75
November.	249	259	247	137	96	267	167	75
December..	254	260	248	141	96	285	167	80
1954								
January...	259	263	250	142	96	300	167	80
February..	258	264	248	142	96	301	167	80
March....	256	264	250	143	96	307	167	80
April.....	257	265	250	145	96	323	167	80

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.

**** Where range of prices for fertilizer material is quoted, average figure is used. The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Arizona Sixteenth Annual Report, Commercial Fertilizers and Agricultural Minerals, Year Ending December 31, 1953," Agr. Exp. Sta., Univ. of Ariz., Mesa, Ariz., Spec. Bul., Feb. 1954.

"Soil Management and Fertilizers for Indiana Orchards," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 385, July 1953, C. E. Baker.

"Louisiana Fertilizer Report 1952-1953," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., E. A. Epps, Jr.

"Inspection of Commercial Fertilizers and Agricultural Lime Products," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Control Series Bul. 158, Nov. 1953, Fertilizer Control Service Staff.

"Massachusetts Seeding and Fertilizing Guide—1954," Agr. Ext. Serv., Univ. of Mass., Amherst, Mass., March 1954, R. W. Donaldson.

"Fertilizer Analyses and Registrations," Dept. of Agr., St. Paul, Minn., 1953.

"The Relation of Defoliation and Nitrogen Supply to Yield and Quality in the Muskmelon," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Tech. Bul. 210, Jan. 1954, R. E. Nylund.

"Effect of Nitrogen from Anhydrous Ammonia and Ammonium Nitrate on Yield and Protein of Oats and Corn in Minnesota, 1953," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 22, March 1954, J. M. MacGregor.

"Apply Anhydrous Ammonia When Plants Need Nitrogen," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sh. 485, Aug. 1953, W. B. Andrews.

"Commercial Fertilizers, Twenty-Fourth Annual Report of the New Mexico Feed and Fertilizer Control Office, Year Ending December 31, 1953," Feed and Fertilizer Control Office, State College, N. Mex., R. W. Ludwick and L. T. Elliott.

"Fertilizers for Field Crops 1954," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 780, Jan. 1954, W. L. Garman.

"Fertilization of Native Grass Pasture on Eroded and Brush Land at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma, Progress Report, 1953," Okla. A.&M. College, Stillwater, Okla., Mimeo. Cir. M-249, Dec. 1953, H. M. Elwell and H. A. Daniel.

"Methods of Applying Fertilizer for Efficient Use," Agr. Ext. Serv., Texas A.&M. College, College Station, Texas, C-347, M. K. Thornton.

"Distribution of Fertilizer Sales in Texas, July 1 to December 31, 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1648, Feb. 1954, J. F. Fudge.

"Yield of Acala Cotton in the Dell City Area as Influenced by Applications of Ammonium Nitrate and Superphosphate, 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1652, March 1954, P. D. Christensen and P. J. Lyerly.

"Yield of Pima Cotton at Ysleta as Affected by Applications of Ammonium Nitrate and Superphosphate, 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1653, March 1954, P. D. Christensen and P. J. Lyerly.

"Grain Sorghum Fertilizer Trials in South Texas, 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1655, March 1954, F. L. Fisher and R. A. Hall.

"Fertilizing Virginia Vegetables," Agr. Ext. Serv., Virginia Polytechnic Institute, Blacksburg, Va., Bul. 212, March 1954, F. H. Scott and A. V. Watts.

"The Use of Boron for the Control of Blossom Blast and Twig Dieback of Pears in Southwestern Washington," Agr. Ext. Serv., State College of Wash., Pullman, Washington, Ext. Mimeo. 1568, Aug. 1953, D. F. Allmendinger, F. Johnson, and V. L. Miller.

Soils

"Soil, Water and Sunshine," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 209, Jan. 1953, H. E. Ray and J. E. Middleton.

"The Changing Fertility of New England Soils," Agr. Exp. Sta., New Haven, Conn., Spec. Bul. Soils XV, Nov. 1953, C. L. W. Swanson.

"Soil Management Practices on Red Bay Fine Sandy Loam," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 537, Jan. 1954, R. W. Lipscomb and W. K. Robertson.

"Soil Testing in Georgia," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Coop. Cir. 1, Jan. 1954, J. Giddens, R. L. Carter, M. Parker, and R. H. Webster.

"Soil Fertility, The Basis for High Crop Production," MFA Plant Foods Division, Columbia, Mo., Dr. G. Smith.

"New Hampshire's Idle Farm Land," Agr. Exp. Sta., Univ. of N. H., Durham, N. H., Sta. Bul. 399, Sept. 1953, W. K. Burkett.

"Warren County Soils, Their Nature, Conservation, and Use," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 773, Sept. 1953, J. C. F. Tedrow.

"Testing Soil for Lime Needs," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 903, Feb. 1954, W. L. Garman.

"Influence of Cropping and Cultural Practices on the Seasonal Trends in Nitrification Rates of Soils Used for Growing Corn in Nebraska," Agr. Exp. Sta., Univ. of Puerto Rico, Rio Piedras, Puerto Rico, Tech. Paper 10, Feb. 1953, P. Landrau, Jr.

"Irrigating Corn," USDA, Wash., D. C., Farmers' Bul. 2059, Oct. 1953, C. J. Francis and J. W. Turelle.

"Soil Survey of Montreal, Jesus and Bizard Islands in the Province of Quebec," Exp. Farms Serv., Dept. of Agr., Quebec, Canada, Dec. 1953, P. Lajoie and R. Baril.

"Soil Survey, Haywood County, North Carolina," USDA, Wash., D. C., Series 1940, No. 11, Jan. 1954, E. F. Goldston, W. A. Davis, C. W. Croom, and W. J. Moran.

"Soil Survey, Norris Area Tennessee," USDA, Wash., D. C., Series 1939, No. 19, Aug. 1953, F. Rudolph, W. Roberts, M. H. Gallatin, M. E. Austin, J. N. Odom, C. Jenkins, L. E. Odom, M. E. Swann, S. R. Bacon, A. J. Vessel, M. J. Edwards, and M. G. Cline.

"Soil Survey, Stewart County, Tennessee," USDA, Wash, D. C., Series 1942, No. 3, Aug. 1953, M. E. Austin, C. R. Beadles, R. W. Moore, B. L. Matzek, C. Jenkins, and S. R. Bacon.

Crops

"Grain Sorghum Experiments, 1950-1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 14, Nov. 1953, R. L. Thurman and A. B. Burdick.

"Arkansas Coastal Plain Corn Performance Test for 1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 15, Dec. 1953, J. O. York.

"1953 Corn Performance Test on Rice Prairie and Similar Soils," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 16, Dec. 1953, J. O. York.

"Arkansas Upland Corn Performance Tests for 1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 17, Dec. 1953, J. O. York.

"Eastern Arkansas Corn Performance Tests for 1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 18, Jan. 1954, J. O. York.

"Arkansas Coastal Plain Cotton Variety Test for 1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 19, Jan. 1954, J. O. Ware and C. Hughes.

"Eastern Arkansas Cotton Variety Tests for 1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 20, Jan. 1954, J. O. Ware and C. Hughes.

"Cotton Experiments in Northeast Arkansas During 1953," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series No. 21, Jan. 1954, J. O. Ware, B. A. Waddle, C. Hughes, and J. F. Jacks.

"Dominion Experimental Farm, Nappan, N. S., Progress Report—1948-1952," Exp. Farms Serv., Ottawa, Ont., Can., Feb. 1954.

"Better Ontario Pastures," Dept. of Agr., Ontario Agr. College, Guelph, Ont., Canada, Bul. 469, July 1949, J. R. Weir.

"Oats in Canada," Dept. of Agr., Ottawa, Ont., Canada, Pub. 554, Nov. 1953, R. A. Derick.

"Quality of Apples as Affected by Sprays," Agr. Exp. Sta., New Haven, Conn., Bul. 576, Oct. 1953, P. Garman, L. G. Keirstead, and W. T. Mathis.

"Storrs Green Hybrid Summer Squash," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., Inf. 50, July 1953, J. Scarchuk.

"Greenhouse Carnations: Successive Direct Planting, Using Single and Double Pinches," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., Inf. 53, Nov. 1953, R. F. Stinson.

"Commercial Gladiolus Production in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 535, Jan. 1954, R. O. Magie and W. G. Cowperthwaite.

"Erect and Trailing Blackberries in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-67, Jan. 1954, R. H. Sharpe and R. D. Dickey.

"Cabbage Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 117, Sept. 1953.

"Potato Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 118, Sept. 1953.

"Celery Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 121, Feb. 1954.

"1953 Variety Performance Trials of Field Crops," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Feb. 1954.

"Steps to Larger Cotton Yields," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 377, Feb. 1954, E. C. Westbrook.

"The Annual Lespedezas," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Press Bul. 651, March 1954, J. M. Elrod.

"State of Illinois Annual Report of the De-

partment of Agriculture, July 1, 1952-June 30, 1953," State Dept. of Agr., Springfield, Ill.

"Dairy Cattle Pasture Management Investigations in Illinois," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Sept. 1953, W. B. Nevens, K. E. Gardner, K. E. Harshbarger, and K. A. Kendall.

"Winter Wheat Production in Indiana," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 390, G. H. Cutler and R. R. Mulvey.

"Annual Progress Report Carrington-Clyde Experimental Farm," Agr. Exp. Sta., Iowa State College, Ames, Iowa, FSR-89, Feb. 1954, H. R. Meldrum.

"Annual Progress Report Howard County Experimental Farm," Agr. Exp. Sta., Iowa State College, Ames, Iowa, FSR-90, Feb. 1954, H. R. Meldrum.

"Produce High Yields of Corn," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Cir. 506, June 1953.

"The Home Fruit Garden," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Cir. 508, June 1953, C. E. Chaplin.

"Research on Maine Farm Problems," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 519, Jan. 1953.

"Care of House Plants," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Bul. 274, June 1953, R. E. Widmer and L. C. Snyder.

"Improved Varieties of Farm Crops," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 22, March 1954.

"Getting Started With Your Vegetable Garden," Univ. of Minn., St. Paul, Minn., Ext. Fldr. 164, Feb. 1954, O. C. Turnquist.

"Maturity Ratings for Corn Hybrids in Minnesota, 1954-55," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 20, March 1954, E. H. Rinke, G. Joachim, and N. C. Olmeim.

"Mississippi Cotton Variety Tests, 1952," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 499, Jan. 1953, J. F. O'Kelly, S. P. Crockett, B. C. Hurt, and K. C. Freeman.

"Mississippi Cotton Variety Tests, 1953," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 509, Jan. 1954, J. F. O'Kelly, S. P. Crockett, B. C. Hurt, and K. C. Freeman.

"1953 Tests Corn Hybrids and Varieties in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 510, Jan. 1954.

"Tracy—A New Mid-Season Variety of Sorgo for Sirup Production in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sh. 483, June 1953, I. E. Stokes, O. H. Coleman, F. O'Kelly, S. P. Crockett, R. Kuykendall, K. Freeman, and B. C. Hurt.

"Research for Better Farm Living," Div. of Agr. Sciences, Univ. of Mo., Columbia, Mo., Jan. 1953, J. H. Longwell.

"Improving Missouri Farm Home Grounds," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 641, Sept. 1953, M. Fitzgerald, L. Woodruff, and H. E. Mosher.

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"Small Fruit Vegetables," Agr. Ext. Serv., Rutgers Univ., New Brunswick, N. J., Ext. Bul. 267, Jan. 1954, E. G. Christ.

"Growing Pinto Beans in New Mexico," Agr. Exp. Sta., N. Mex. College, Las Cruces, N. Mex., Bul. 378, May 1953, S. Paur.

"Plant Studies of Production Methods for Vegetable Crops," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Bul. B-421, March 1954, F. A. Romshe.

"Indian Grass and Switch Grass," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Leaf. 17, March 1954.

"Side-Oats Grama," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Leaf. 18, March 1954, J. R. Harlan.

"1952 Petunia Trials at the Pennsylvania State University," Agr. Exp. Sta., Pa. State Univ., State College, Pa., Prog. Rpt. 113A, Jan. 1954, R. P. Meahl, L. D. Little, Jr., and S. Atmore.

"Cotton Production Insect and Disease Control, South Carolina—1954," Agr. Ext. Serv., Clemson, Agr. College, Clemson, S. C., Cir. 393, Feb. 1954.

"Sudangrass for Summer Pasture," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Leaf. 132, Aug. 1953, W. Pendergrass.

"Let's Produce More Corn," Agr. Ext. Serv., Texas A.&M. College, College Station, Texas, B-209, June 1952, E. A. Miller, L. C. Coffey, and W. B. Coke.

"Growing and Marketing Watermelons," Agr. Ext. Serv., Texas A.&M. College, College Station, Texas, B-216.

"Onions in Texas," Agr. Ext. Serv., Texas A.&M. College, College Station, Texas, B-220, Sept. 1953, J. E. Hutchison, B. G. Hancock, and B. A. Perry.

"Sudan for Grazing and Hay," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1657, March 1954, E. C. Holt and F. L. Vaura.

"Silage Crop Variety Test at Kirbyville, 1953," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Prog. Rpt. 1658, March 1954, J. R. Wood and C. A. Burleson.

"Growing Shrubs and Trees from Cuttings," Agr. Ext. Serv., Texas A.&M. College, College Station, Texas, C-332, 1953, S. Hatfield.

"Seasonal Pastures for Year-Round Grazing in the Rio Grande Plain," Agr. Ext. Serv., Texas A.&M. College, College Station, Texas, L-168, 1953, E. M. Trew.

"The Puyallup Red Raspberry," Agr. Exp. Sta., State College of Washington, Puyallup, Wash., Sta. Cir. 238, Dec. 1953, C. D. Schwartze and A. S. Myhre.

"Growing Chestnuts from Seed," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Cir.

90, Jan. 1954, R. W. Pease.

"Field Crop Varieties in Wisconsin," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 463, Dec. 1953.

"Report of the Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, 1953," USDA, Wash., D. C., 1954.

"Growing Alfalfa," USDA, Wash., D. C., Farmers' Bul. 1722, Rev. Feb. 1954.

Economics

"The Use of Airplanes on Rice Farms in Arkansas," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 541, Dec. 1953, M. W. Slusher.

"Cost of Production Report, Tomatoes for Processing," Dept. of Agr., Toronto, Ont., Canada, 1954, J. B. Nelson.

"The Agricultural Outlook for Canada, 1954," Dept. of Agr., Ottawa, Ont., Canada, Jan. 1954.

"Connecticut Vegetable Acreages, 1950-1953," Dept. of Agr., Hartford, Conn., Bul. 128, Jan. 1954.

"The Floricultural Industry of Connecticut," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., INF-52, Oct. 1953, A. W. Dewey.

"Custom Rates for Farm Operations," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 134, Rev. Feb. 1954, R. B. Zoller and T. R. Nodland.

"Field Management Guide," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 189, Aug. 1953, S. B. Cleland.

"Opportunities in Producing and Marketing Strawberries in New Hampshire," Agr. Exp. Sta., Univ. of N. H., Durham, N. H., Sta. Bul. 400, Nov. 1953, L. A. Dougherty.

"The Cotton Plantation in Transition," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 508, Jan. 1954, H. A. Pedersen and A. F. Raper.

"Post Harvest Handling and Marketing of Garden Fresh Sweet Corn," Agr. Exp. Sta., Wooster, Ohio, Res. Cir. 23, Feb. 1954, E. K. Alban and R. C. Scott.

"Ohio Agricultural Statistics 1951 and 1952," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 735, Rev. Dec. 1953.

"The Influence of Location on Farmland Prices," Agr. Exp. Sta., Okla. A.&M. College, Stillwater, Okla., Bul. B-417, March 1954, L. A. Parcher.

"Cost of Producing Apples and Pears in the Hood River Valley, Oregon, Progress Report VI," Agr. Exp. Sta., Oregon State College, Corvallis, Oreg., Cir. of Inf. 535, Dec. 1953, G. W. Kuhlman and A. E. Irish.

"Achieving Farm Ownership in South Dakota Through the Farm Ownership Program of the Farmers Home Administration," Agr. Exp. Sta., S. D. State College, College Station, S. D., Agr. Econ. Pamph. 47, July 1953, C. M. Johnson.

"1952 Tenth Annual Report Southeastern South Dakota Farm Record Summary," Agr. Exp. Sta., S. D. State College, College Station, S. D., Agr. Econ. Pamph. 48, Aug. 1953, A. R. Clark.

"A Long Range Farm and Home Program," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Nov. 1953.

"Fruit and Vegetable Statistics for Texas," Agr. Exp. Sta., Texas A.&M. College, College Station, Texas, Cir. 135, Dec. 1953, C. A. Bonnen and L. P. Gabbard.

Fertilizer Analyses . . .

(*From page* 12)

were materially increased. This was a result of applying potassium chloride equivalent to 160 pounds K_2O an acre annually over the 10-year period. The annual rainfall at New Brunswick, New Jersey, where the tests were located, averages over 45 inches a year, and supplemental irrigation was practiced as required.

It seems important to point out that more than nitrogen, phosphoric acid, and potash are required by crops. With increasing intensity of production it becomes increasingly necessary to check on the supplies of all the other essential nutrients. But a low-analysis fertilizer doesn't necessarily contain all the needed nutrients any more than a high-analysis one. Even if it does, they may not be present in the best ratios. In other words, we are moving in the direction of having all the needed elements supplied in accordance with soil and crop needs rather than by the hit-and-miss procedure of low-analysis fertilizers.

Those who desire to study the data developed in connection with this work can find it in the original paper by F. E. Bear, A. L. Prince, and S. J. Toth on "Effect of increasing fertilizer concentration on exchangeable cation status of soils," published in Soil Science Proceedings 16:327-330, 1952.

The Changing Fertility of New England Soils

(*From page* 26)

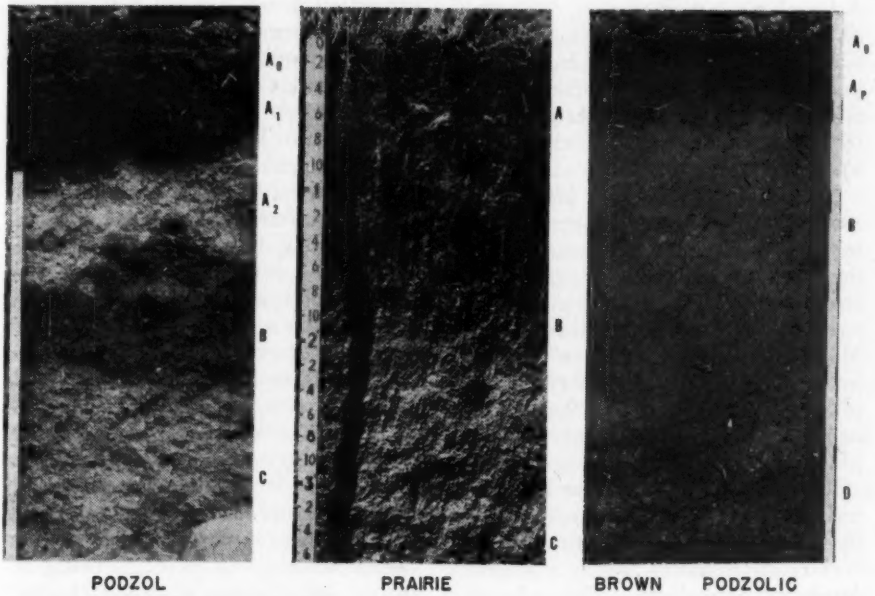

Fig. 6. Profiles of Brassau sandy loam, a Podzol developed from granitic till in New Hampshire; Tama silt loam, a Prairie soil developed from loess in Iowa; and Merrimac sandy loam, a Brown Podzolic developed from granitic glacial outwash materials in Connecticut. Note the thin A horizons and sandy texture of the Podzol and Brown Podzolic soils in comparison with the deep A and fine texture of the Prairie soil. The Ap horizon of the Brown Podzolic soil consists of the upper B and the original A1. This soil is now in forest with trees 75-100 years old.—*Photos of Podzol and Prairie soils courtesy R. W. Simonson, Soil Conservation Service.*

sively farmed areas such as in the Connecticut Valley and in Aroostook County, Maine.

The fact that 77 per cent of New England is forested and that 80 to 85 per cent of the agricultural land is in hay or pastures means that this land has optimum cover for soil and water conservation. Much of the land surface is frozen or covered with snow a large part of the year. The sloping areas are largely in forests or grass, and furthermore, most of the precipitation is gentle.

The texture of the soils is predominantly sandy and so conditions for percolation of the rainfall into the soil are more conducive than in finer-textured soils. Because of the characteristic knob-and-kettle type of topography in New England, not as much soil gets into the streams as in gentler sloping areas because the soil is caught in the depressions. These depressions are exemplified in the numerous small swamps and peat bogs existing everywhere in New England.

Erosion affects the physical nature of soils in New England more than its chemical status. Removal of the already low amounts of fine materials (silt and clay) means that less fertility-holding material is left. Fertilizers will then leach more quickly as well as wash down the slope. Removal of soil from soils with compact layers at about 18 inches like the Paxton, Wethersfield, and Essex results in less friable, loose

soil for holding of water, less space for plant roots, and more heaving of plant roots in the spring.

Originally Only 2-3 Inches Thick

One needs to think of topsoil in a different sense than the way it is used, for example, in Iowa. In New England forests, the topsoil under virgin conditions was never more than 2 or 3 inches thick. In Iowa, topsoil measures 12 to 18 inches under virgin prairie (Figure 6).

In New England, the topsoil consists of the thin A horizon incorporated by plowing with the upper part of the B horizon (Figure 6). So we really are farming "man made" soils in comparison with those in the Midwest. The Midwest soils have "built-in" fertility; in New England, the fertility is "built into" the soils. We have different kinds of management for these two different kinds of soil.

The productivity of New England's soils has been greatly improved mainly by large applications of commercial fertilizers and manures used in a generally intensive agriculture. On cultivated soils especially, we should be concerned about the fertility we are losing because of erosion. Little natural fertility is lost from New England's virgin soils by soil removal because these soils never were fertile.

Factors for Increased Fertility

Three factors are favorable for increasing the fertility of many of New England's soils. These factors are: (a) Fertilizers have been used in New England longer than in any other section of the country. In fact, the Connecticut Agricultural Experiment Station at New Haven, the first agricultural experiment station to be established in the United States, was started in 1875 principally to do work on fertilizers. It has been said that the fertilizer industry started in New England. (b) Because of the intensive nature of many of the crops grown, like tobacco, potatoes, and vegetables, high rates of fertilizer are used (Table II), and plant nutrients like P, K, and Ca tend to accumulate in the soil. (c) Large amounts of feed are shipped into the area to supplement locally produced grain and hay. Much of these feeds is returned to the soil in the form of manure.

A summary of the fertility status of New England's soils based on a study of the amount of plant nutrients added by application of fertilizers and lime, manure, turning under of green manures, crop residues, and legumes, rainfall and the like, in comparison with the amount removed by crops harvested, leaching, and loss by soil erosion, follows.

More N is being applied to the soils than is being removed if a balance sheet of input is drawn including that shipped in as feeds, biological fixation, rainfall, leaching, crop removal, fertilizers applied, etc. About 2½ times as much P_2O_5 is being applied annually to New England soils as is being removed. Either manure or fertilizer alone appears to supply as much as is lost. About 60 per cent of K is being returned considering what is removed. These are averages for the region, and cannot be applied to any given farm or field.

In New England, about 4½ times as much CaO and more than twice as much MgO is applied to cropland as is removed in harvested crops but yet the percentage replacements of these nutrients are only 47 and 34 per cent, respectively.

The removal of N, P_2O_5, and K_2O for the years 1942 and 1948 in crops harvested was in the ratio of 1.00-0.28-1.16.

Evidence of Fertility Changes

Potato yields in Maine are now 4½ times as large as they were 80 years ago; for the other five States, they are double the 1866-69 average. This enormous increase is explained partly by shifts to soils adapted to the crop, increased fertilizer use, and new pesticide controls.

Probably the greatest accumulation of nitrogen is occurring on dairy and fruit farms since they generally are located on the finer-textured soils. Without doubt many dairy farmers, who buy feed and apply manure to their land, are building up the nitrogen content of their soil. On the other hand, other farmers, by intensively cropping their soil without adequate replacement of nitrogen, are depleting theirs. Intermediate may be the tobacco, vegetable, and potato farms where as much as 200 pounds of nitrogen per acre is added annually. The coarse-textured nature of the soils on which these crops are usually grown allows more leaching of N than from the finer-textured soils. Conditions for accumulation of N in these coarse-textured soils, therefore, are not favorable.

It is possible, although concrete proof appears to be lacking, that some of these soils cultivated for two centuries or longer are higher in nitrogen and organic matter now than they were 50 years ago before large quantities of manure from imported feeds and commercial fertilizers were applied. Considerable quantities of manure from livery stables were brought into the region from cities like New York up until about 20 years ago.

We know that CaO is being lost because farmers have to apply lime every three or four years to maintain the pH of the soil at a satisfactory level. Magnesium deficiency on heavily fertilized and intensively farmed land points to Mg losses. Benefits from K_2O applications on clover, tobacco, and other crops substantiate K_2O losses. Soil analysis confirms P_2O_5 build-up.

Potash is being removed from New England soils more rapidly than it is being supplied. Weathering of potash-bearing minerals supplies some potash, but of the three primary nutrients, potash seems to be in the least favorable position. It helps to explain why Maine has come to use a larger tonnage of potash than of either nitrogen or phosphoric oxide as fertilizer and relatively more potash in fertilizers than any other State.

Cultivated Soils More Fertile

Results from Maine, New Hampshire, Connecticut, and Rhode Island show that, generally speaking, cultivated soils are higher than forested soils in available P_2O_5, K_2O, MgO, CaO, lower in per cent organic matter, and higher in pH. In some cases, soils used for potatoes may be somewhat lower in CaO since potato soils usually are kept below a pH of about 5.2.

Organic matter and nitrogen in many intensively cultivated soils, however, are decreasing and these decreases are reflected in the poor physical condition of the soils. For example, some of Connecticut's soils to plow depth have lost one third their organic matter and one eighth of their nitrogen, and the cultivated soils weigh 2½ times as much per unit volume as forested ones. The poorest of the cultivated soils weighs 40 per cent more than the best. On many fruit and dairy farms soil nitrogen is accumulating.

Each kind of farming is associated with its own particular soil fertility status. Intensively cropped soils on vegetable, tobacco, and potato farms are higher in fertility than ever before. Dairy and fruit farms probably are higher in organic matter and nitrogen than under virgin conditions. Many general type farms probably are somewhat higher in fertility, especially if fertilizers have been used rather liberally. If manures and fertilizers have not been used, the fertility probably is lower than under forested conditions. But with proper soil management, the soils of most farms in New England can be brought up to high productivity.

Although the fertility status of the region as a whole is improving, the rate is so slow as to give no cause for complacency. Soils on many farms are not following this upward trend, and continuing thought and effort must be put into the maintenance and improvement of agricultural soils in this region.

Fruit Tree Fertilization Important

FERTILIZING fruit trees is an important and extremely complex orchard operation, according to Vernon Patterson, Ohio State University Fruit Specialist. Kind and amount of fertilizer required depend on age of trees, soil fertility, past fertilizer treatment, and soil management practices.

"Rules of thumb" provide a starting point for fruit fertilization. The general guide for apple trees is ¼ pound of 16% nitrogen fertilizer for each year of age of apple trees. The guide for peach trees is ⅓ pound of 16% nitrogen fertilizer. Equivalent amounts of fertilizers higher in nitrogen may be substituted.

Patterson says fruit growers should vary amounts of nitrogen according to the vigor of the tree. Bearing apple trees should make from 10 to 15 inches of shoot growth each year. Peach trees should make 15 to 18 inches of annual shoot growth.

Peach trees growing in sod require 2 to 3 times as much nitrogen as when they are cultivated.

Fruit trees need phosphorus and potash too. They benefit indirectly from these elements through increased growth of cover crops. Patterson suggests a basic application of 300 to 400 pounds of 0-20-20 every 3 or 4 years. Growers can apply nitrogen, phosphorus, and potash in one application, using 10-10-10 or similar analysis fertilizer.

Nitrogen fertilizers should be applied 3 to 4 weeks before full bloom. Later supplemental applications may be sprayed on apples at petal-fall time if a large crop is in prospect.

Supplemental nitrogen on peaches should be ground applications during May and early June. Phosphorus and potash may be applied whenever it's convenient.

Research work has not indicated a need for general applications of trace elements such as boron, manganese, and magnesium. These elements may be needed in isolated cases, the Specialist adds. He suggests test applications in small areas where orchardists think trace elements are needed.

How to Cut Production Costs

FARMERS faced with the problem of increasing farm costs may lower them by using improved fertilizer and other cultural practices, according to cooperative investigations reported by the U. S. Department of Agriculture and the Michigan Agricultural Experiment Station.

The studies, carried on by economists and soil scientists, showed that based on 1953 prices, improved practices (as compared with practices currently used) cut the cost of producing a bushel of wheat from $1.65 to $1.28, of oats from 90 cents to 69 cents, and of corn from $1.21 to $1.02. Recommended practices lowered the cost of producing a ton of alfalfa-brome grass hay from $16.80 to $13.30 and a ton of sugar beets from $11.21 to $8.19.

Using recommended rates of fertilizer is the one cultural operation that results in the biggest saving, but other practices, such as timely planting, use of adapted varieties, seed treatment, crop rotation, soil management, tillage, and weed control, can each cut production costs. However, with all five crops, production costs were reduced most when all fertilization and cultural practices were employed. (Recommended

practices, which may vary in different areas, may be obtained from county agricultural agents or the state extension service.)

The researchers found that it was necessary to spend more money per acre to follow proved practices, but the resulting greater per-acre yields more than offset the extra expenses. For example, they found that today's average Michigan farmer spends $46 an acre to produce 38 bushels of corn. By spending $62.25 an acre—the cost of recommended practices—he would produce 61 bushels of corn from each acre.

The tests show that Michigan farmers are not, on the average, using enough fertilizer to produce crops most economically. Currently, sugar beets are fertilized at an average rate of 490 pounds an acre. The recommended rate is 800 pounds. By increasing fertilization to recommended levels, the grower could cut the cost of producing a ton of beets from $11.21 to $9.95. Further, by application of other recommended practices, he could reduce his costs to $8.19 a ton.

Making Worthless Land Produce

FROM worthless land to highly productive pasture—that's the story of a new farming program developing in the central part of Wisconsin.

The program involves a special terrace and land leveling operation plus pasture improvements. Fields that were once wet, soggy, and poorly drained are now producing heavy crops of legumes and other forages. Many fields in the three million acre Spencer soil area can possibly be improved.

Fields were first levelled and terraced at the Marshfield branch agricultural experiment station and the program showed promise. Then farmers in the area took up the idea as special projects three and four years ago. The farmers report that these fields have already returned several times the investment needed to improve them. The project has been developed under the supervision of R. F. Johannes, at the branch station, and agricultural specialists from the University of Wisconsin.

For example, an acre of a terraced and levelled field at one farm produced pasturage that netted $234 in terms of milk production. On a 7½ acre field, another cooperating farmer pastured 25 Holsteins for 81 days without supplemental feeding. Milk production was good, Johannes reports.

Bromegrass, timothy, and ladino clover flourished on the terraced and levelled areas, while undesirable grasses and weeds moved into unterraced sites. Native pastures were much less productive than improved pastures.

Pastures on terraced and levelled fields averaged 700 pounds more dry forage than pastures on unterraced fields over three years of tests.

Pastures on all fields had been improved by liming, reseeding, and in some cases, fertilization. These practices alone doubled the yield over native pastures.

Fertilization helped increase yields. An application of 1,500 pounds of 0-20-20 gave an average yield increase of around 1,200 pounds per acre per year over unfertilized improved pastures. An application of 500 pounds of 0-20-20 gave a yield increase of around 600 pounds dry forage per acre. These increases were averaged for both terraced and unterraced fields because there was little difference in fertilizer effects due to terracing.

Cooperating in these tests were Johannes, A. J. Wojta, D. R. Peterson, M. J. Wright, J. M. Sund and C. B. Tanner.

Potential of Fertilizer Use...

(*From page* 16)

use as given in Table II, would increase the yields of hay 22%, pasture 15%, soybeans 19%, and corn 7%.

Increasing the application of fertilizer on high fertilizer-using crops, such as tobacco, does not greatly increase the yields.

Production Potentials

Some of the most interesting data given in the report deal with the production potentials of the North Central region. The production potentials of the major fertilizer-using crops are given in Table III. This Table shows that in an average year with full fertilization, corn yields could be increased from 44 to 65 bushels per acre in the North Central region, an increase of well over a billion bushels per year; yields of wheat could be more than doubled, from 14 to 29 bushels per acre, with an increase of nearly 650 million bushels per year. Barley yields could be nearly doubled, rye yields more than doubled, oat yields increased from 35 to 58 bushels per acre, potato yields more than doubled, and the same is true for hay.

Estimates of yield potentials in the North Central region are very conservative and reflect generally only the increase that could be expected from the increased application of fertilizer. Continued heavy fertilization, with resultant increases in active soil organic matter, would improve soil tilth and aeration and thus contribute to still further increases in yield. Improvements in farm machinery, particularly seed distribution and fertilizer placement, tillage operation, methods of controlling insects and diseases, and improved plant varieties would all contribute to greater increases in yield when combined with adequate fertilization.

It is entirely possible that corn yields could be doubled with all of these improved practices rather than increased 50 per cent as shown in Table III. Similar increases over estimated potential yields for other crops could also be expected. Crop quality, as evidenced by mineral and protein content, would also be improved.

The amount of fertilizer necessary to produce maximum yields is, of course, very large, particularly when

TABLE III.—PRODUCTION POTENTIAL OF MAJOR FERTILIZER-USING CROPS IN THE NORTH CENTRAL REGION.

Crop and unit	Yield in 1950		Potential yield with full fertilization		Increase obtainable with full fertilization 1000 units
	Average per acre	Total for region 1000 units	Average per acre	Total for region 1000 units	
Corn, bu.	44	2,438,694	65	3,586,314	1,147,620
Wheat, bu.	14	598,954	29	1,247,820	648,866
Rye, bu.	14	6,998	30	14,889	7,891
Barley, bu.	19	85,355	37	167,363	82,008
Oats, bu.	35	996,095	58	1,660,158	664,063
Soybeans, bu.	24	188,792	34	265,904	77,112
Potatoes, bu.	144	100,954	335	234,777	133,823
Hay, tons	2	42,842	4.3	93,135	50,293

such practices are just started. In Wisconsin some tests have been made showing that in order to obtain maximum yields it would be necessary to increase fertilizer consumption from 400,000 tons to between two million and two and one-half million tons of fertilizer annually.

Crop requirements for maximum yields would undoubtedly be much less after initial heavy applications of fertilizer had been made for a few years. Recent experience on the East Coast with heavy fertilizer over a period of years indicates that considerable build-up of available plant nutrients occurs in the soil. Recent Wisconsin experiments indicate that high crop yields can be maintained with initial heavy applications of phosphate and potash, and with subsequent smaller amounts. Although supplies of available nitrogen will increase with increased crop growth, usage by crops will also be greater and will require rather constant high levels of application for top yields.

If all-out food production becomes necessary, present yields can be about doubled in the North Central region with adequate fertilization and other improved practices.

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Demonstration Farms . . .

(*From page* 10)

purchase the needed concentrates. If I plow up sod for corn or small grain, I will have the expense of getting my acres back into sod. Also through an all-grassland program I can reduce my investment in machinery and level out the required labor peaks."

One of the best examples of soil and water conservation is found on the test demonstration farms. Dense sod holds the water where it falls, to be absorbed into the soil and provide underground water for a more uniform stream flow.

This group of farmers is not only conserving soil but is building its fertility. Soil texture is being improved and the water-holding capacity increased. A few years ago many fields had only the subsoil left with which to work, due to the continued use of the plow. Now after several years of a good sod cover, the soil of these same fields is turning dark from organic matter. Much of the soil on these farms is now more fertile than in the virgin state, since the present plant nutrient content is higher.

These demonstrators are proving that farm units do not have to be large to produce commercially or efficiently. Through the type of farm planning and development found on these farms where most of the labor is provided by the owner-operator and his family, we can still retain the type of agriculture that reflects true democracy in rural America.

Although the problems of developing the nation's agriculture for maximum production varies widely from section to section, at least some of the answers

to problems of this area are being found on test demonstration farms. Even though other farmers are adopting improved methods and practices from the demonstration farms, their ultimate production is far from realized. When all farms of this area are developed intensively along the pattern of test demonstration farms, the farm output will be more than doubled.

The test demonstration farmers will tell you that this area can fill its "fifth plate" by growing more and better grass through the liberal use of plant nutrients, utilizing the grass through good livestock.

Fig. 6. This field of alfalfa on the Wilcox farm has yielded over five tons of hay per acre each year for three years. Liberal amounts of fertilizer were used each year.

Oregon Can Produce . . .

(*From page* 20)

Were blossoms removed from the new planting during the first season?

Number of growers	Tons/A (Marshalls)
Yes—41	3.4
No—34	3.8

This result is in reverse to the thought that blossom removal allows the strength to go into the plant. Most growers do not remove the bloom early enough and the damage is already done. The removal adds to this damage when done at the later date.

Depth of spring cultivation is very important and is shown in the following results:

Depth	Number of growers	Tons/A (All varieties)
Under 1.5 inches	12	5.3
1.5–2.0 inches	39	3.9
2 inches and over	39	3.2

The removal of tops after harvest showed good results.

Number of growers	Tons/A (All varieties)
Yes—52	4.2
No—38	3.4

Cutting down of the matted row to a moderate width or use of individual hills gave best results. This cutting was done soon after the harvest season.

Width	Number of growers	Tons/A (All varieties)
6–12 inch	35	4.0
13–14 inch	23	4.0
15 inch and over	32	3.6

A good healthy fall growth is necessary if a heavy crop of strawberries is to be set.

Fall growth	Number of growers	Tons/A (All varieties)
Heavy	50	4.3
Medium	18	3.4
Poor	22	3.2

Virus was a definite limiting factor in most of the fields in the survey.

Virus a factor	Number of growers	Tons/A (All varieties)
Yes	88	3.8
No	2	4.5

Where rot was considered a factor, the growth was heavy and production good. If the berries had not rotted, the production would have been considerably better. Less nitrogen and possibly more potash might have accomplished this.

Rot was a definite factor with 47 growers producing 3.9 tons per acre average (all varieties).

Rot was not a definite factor with 43 growers producing 3.4 tons per acre average (all varieties).

What does this all add up to? It gives the research men very definite problems to work out. It also gives all of us rather strong indications that certain things should be done until more definite proof is available. Some of these things are:

1. Prepare well-selected soil so that the plants will have an abundance of organic matter and a good, well-balanced fertility.
2. Use the best certified planting stock and avoid mixtures of varieties or strains.
3. Spring cultivation must be shallow or feeder roots will be injured. Under 1½ inches seems best.
4. Irrigate as necessary if possible.
5. Remove bloom as soon as noted on the new planting.
6. Keep matted rows down under 14″ for best results. Cutting down should be done within a few weeks after harvest. Fertilizer should be placed beside the rows and two to three inches deep at this time.
7. Obtain a healthy, moderate to heavy growth in the late summer and early fall in order that good potential crop may be set.
8. Avoid poor drainage of air or water.
9. Virus is definitely a limiting production factor and should be controlled by a community-wide dusting program to control the aphid vector.

Opening Doors

(*From page* 5)

field of farming eagerly scan the horizon every spring for likely young grads who can tackle the tough competitive situation with fresh ardor and vim. After some experience in these lines, many well-trained fellows start their own enterprises. If they are especially ambitious and keen, they make fair

to excellent careers for themselves operating machine service shops, chick hatcheries, cotton gins, saw mills, feed mills, nurseries, seed stores, dairy manufacturing plants, and storage locker outfits.

EACH year a considerable percentage of our best ag graduates join the "bureaucratic" army in state and federal offices. Entrance often comes originally earlier in the college career by means of apprentice training. With this summer or part-time experience behind him, the graduate fits better into regulation civil service. He joins the state department of agriculture, goes into some state college or experiment station effort, or takes an appointment with the USDA, Department of the Interior, or the Food and Drug Administration.

Relatively secure as a technician in these posts, the graduate stands on an exciting threshold with a wide horizon in foreign service open to him—if he wants a change from routine domestic experiences. Those who have a yen and a yearning for work abroad often get by without too much difficulty and without as much prerequisite sometimes as domestic duties require. You get in close touch with some influential group and before you know it attractive overseas assignments are yours with the Department of State, Foreign Operations Administration, Foreign Agricultural Service of USDA, or the Food and Agriculture Organization of the United Nations. In late years similar foreign jobs are open with the big corporate trusts and foundations, who are free to hire and fire much on their own initiative as they please.

Or, suppose your candidate belongs to the minority who possess true and thorough scientific spirit, who have had the right amount of college training, and who earnestly wish to find fresh answers to old, irritating, and costly problems. They are not anxious to go abroad or join a sales force at home or push their way against hard knocks in a keen business world. For a time they are content to labor quietly and obscurely under the leadership of some master of the inquiring arts. There is much to be said in praise of these chaps who seek the blind trails to unknown goals. You've got to respect those persons who seek something besides the dollar sign to emblazon on their personal coat of arms. Without those of their kind who have followed the same tortuous pathway, the merchandise so glibly hawked and advertised by the super salesmen would not be available at all.

I've always felt that many of these tireless research delvers were actually closer akin to the working farmer than many of our boasted go-getting business friends. For the man in the furrow and the feedlot is also a constant asker of questions, a searcher for new truth, and a producer who strives for ultimate perfection.

RESEARCH in agriculture arises from scientific education. It thrives and grows on curiosity and imagination. It depends on good teamwork to reach mutual goals. It raises our level of living and helps us to improve mentally and spiritually. To aspiring youth, it's the master key to the American way of life and achievement.

To the urban dweller, research means atomic energy, miracle drugs, vitamins, motor equipment, electronics, and television. To the farmer, research means all that too, plus hybrid corn, better livestock, sounder farm management, disease-resistant crops, more fertile soils, and better control of insects, weeds, and similar pests.

Agricultural research is making something known out of the unknown; something visible out of the invisible; developing substances that heal, protect, and stimulate out of chemicals and molds; making things work that never

worked before; making good and useful things out of wasted and discarded ones; finding wider markets and better marketing methods; and aiding capable farmers and their soils, plants, and livestock to feed the nation's rapidly growing population—often with plenty to spare.

Research is making the scientific laboratory and workshop into a new and inexhaustible frontier, to replace the "new land" we have no longer. In the next 20 years, it is estimated that a team of research workers numbering 20,000 to 25,000 well-trained minds will be needed to solve agricultural problems. Most of these persons are the agricultural grads and post-grads of the present time.

Authorities in positions of trust have stated that farming is always creeping up on new scientific facts and utilizing findings so fast that the original sources have a hard time manufacturing more answers and more remedies. This in itself is a challenge to every branch of the physical and social sciences. Nowhere is there greater chance to train folks in sufficient numbers to meet this strong demand than in our well-established Land-Grant colleges.

ANNUAL public expenditures for agricultural research, both state and federal, total about $113 millions. Industry allied with agriculture spends about $140 millions yearly on research. Much of the latter is spent on farm machinery, agricultural chemicals, food and textiles, and forest products. The USDA has about 500 scientists doing research. The state agricultural experiment stations together employ about 7,000 scientific workers, some of whom divide their time between research, teaching, and extension activities. Private industry uses many more.

But men must live while they work. This era is a far more expensive one than the period faced by the older generation when school days ended. Not many "surveys" cover this particular field in a reliable way. But we

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have seen a recent one made by a Midwest agricultural college, in which the alumni were asked to indicate their annual salaries for the year 1953.

Fully 45 per cent of them reported incomes within the $4,000-$6,000 bracket. Another 26 per cent said their incomes were less than $4,000 and about 29 per cent declared incomes of more than $6,000. A few graduates in all fields of employment had earnings of $10,000 or more per year. The percentage of those working in private industry who were earning this sum was a trifle greater than was true of public employees. However, the graduates entering private industry generally began at lower salaries than did the public employees.

Government agriculturists employed by federal and state agencies in general received a starting salary somewhat lower than vocational teachers, but a larger proportion of them earned a higher income after 15 years of experience. The average reported earnings by alumni engaged in farming last year compared quite well with what was earned by others in different occupations. Yet here the drawback always obtrudes to frustrate ambitious farm youth—how can a guy get a good farm and pay for it?

THE competition between agricultural colleges to attract recruits is matched by the competition between various agencies to secure the services of the best minds when they have been certified with a diploma. This has more advantages than disadvantages. None of us ever wants to see a return of those lean and scrimpy years when educated men were a drug on the market because of the slight use made of them in agriculture. They could be teachers, county agents, or follow the plow. Beyond those fields there was practically nothing.

We realize that the fellows of those days made the most of their educational opportunity. They laid some strong foundations for what we have today. Maybe they actually turned the switch that has flooded us with new light and power. Maybe their examples showed us the way.

TODAY a certain amount of rivalry to secure and maintain topnotch educational facilities in men and means seems to animate the agricultural colleges. One hears authorities say that this school or that campus or that professor outranks and outsells the drawing power of another elsewhere. There is almost as much pulling and hauling of personnel in many of our good colleges as exist in the baseball trading system. But even then, many declare our agricultural staffs and facilities lag far behind those of the athletic departments and other show windows of modern academies.

High-toned salesmanship and public relations fanfare seem to be accepted necessities. Probably they have to be, in this period when competition looms larger sometimes than conviction and there are so many waving hands, bright colors, and novel stunts to attract attention and "make a sale." We must resign ourselves to the situation—we old-timers who return to the beloved campuses for a few years of retrospect and progress. None of us would want to see agriculture fall behind in the race for attention and her share of glory and reward. But somehow, somewhere there always comes the heartfelt wish that no abandonment of the simple integrity of other semesters be allowed to obscure the true meaning and message of an educated man.

Agriculture is too basic and traditional to be riddled and raddled with unworthy or flashy claims and baits. We are thankful that the truth still holds enough promise and that false doctrines lend no extra power to the attraction that agricultural colleges possess over thoughtful and hopeful youth.

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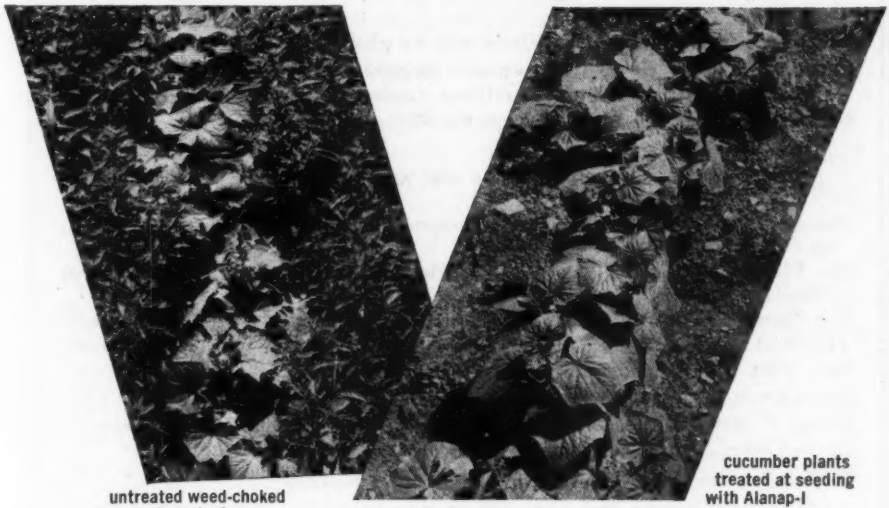

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The Plant Speaks Thru Tissue Tests (Sound, running time 14 min. on 400-ft. reel.)

The Plant Speaks Thru Leaf Analysis (Sound, running time 18 min. on 800-ft. reel.)

Save That Soil (Sound, running time 28 min. on 1200-ft. reel.)

Borax From Desert to Farm (Sound, running time 25 min. on 1200-ft. reel.)

Potash Production in America (Sound, running time 25 min. on 800-ft. reel.)

In the Clover (Sound, running time 25 min. on 800-ft. reel.)

In Canada: The Plant Speaks Thru Deficiency Symptoms
The Plant Speaks, Soil Tests Tell Us Why
The Plant Speaks Thru Tissue Tests
The Plant Speaks Thru Leaf Analysis
Borax From Desert to Farm
Potash Production in America

DISTRIBUTORS

Northeast: Educational Film Library, Syracuse University, Syracuse 10, N. Y.

Southeast: Vocational Film Library, Department of Agricultural Education, North Carolina State College, Raleigh, North Carolina.

Lower Mississippi Valley and Southwest: Bureau of Film Service, Department of Educational Extension, Oklahoma A & M College, Stillwater, Oklahoma.

Midwest: Visual Aid Service, University Extension, University of Illinois, Champaign, Illinois.

West: Department of Visual Education, University of California, Berkeley 4, California.
Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.
Department of Visual Instruction, Oregon State College, Corvallis, Oregon.
Bureau of Visual Teaching, State College of Washington, Pullman, Washington.

Canada: Canadian Film Institute, 172 Wellington Street, Ottawa, Ontario.

For the Province of Ontario: Distribution Services, Ontario Agricultural College, Guelph, Ontario.

IMPORTANT

Requests should be made well in advance and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of loan.

Request bookings from your nearest distributor.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Reprints

28-12-45 Better Corn (Midwest) (Circular)
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What is the Matter with Your Soil?
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
A-1-44 What's in That Fertilizer Bag?
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—The Aristocrat
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
I-2-47 Fertilizers and Human Health
T-4-47 Fertilizer Practices for Profitable Tobacco
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
R-4-48 Needs of the Corn Crop
X-6-48 Applying Fertilizers in Solution
AA-6-48 The Chemical Composition of Agricultural Potash Salts
GG-10-48 Starved Plants Show Their Hunger
OO-11-48 The Use of Soil Sampling Tubes
SS-12-49 Fertilizing Vegetable Crops
BB-8-50 Trends in Soil Management of Peach Orchards
I-2-51 Soil Treatment Improves Soybeans
X-8-51 Orchard Fertilization Ground and Foliage
BB-10-51 Healthy Plants Must Be Well Nourished
II-12-51 Pasture Improvement With 10-10-10 Fertilizer
KK-12-51 Potassium in Animal Nutrition
A-1-52 Research Points the Way to Higher Levels of Peanut Production
E-2-52 Ladino Clover—Its Mineral Requirements & Chemical Composition
H-3-52 The Relative Merits of Inorganic & Organic Sources of Plant Nutrients
L-4-52 Efficient Use of Fertilizer in the Southern Region
O-4-52 Tomato Production for the Canning Industry
Q-5-52 Potassium-nitrogen Balance for High Corn Yields
Y-10-52 The Nutrition of Muck Crops
CC-12-52 The Leaf Analysis Approach to Crop Nutrition
B-1-53 Commercial Fertilizer Is a Sound Investment
F-2-53 Grasses and Weeds—The Potash Robbers
I-2-53 Sericea Is a Good Drought Crop
J-3-53 Balanced Nutrition Improves Winter Wheat Root Survival
K-3-53 Kudzu Keeps Growing During Droughts
N-4-53 Coastal Bermuda—A Triple-threat Grass on the Cattleman's Team
P-4-53 Learning How to Make Profits from Sweet Potatoes
S-5-53 More Cotton on Less Land
T-5-53 Trefoil Is Different
U-5-53 Grassland Farming Is Planned Prosperity
W-6-53 The Development of the American Potash Industry
AA-8-53 Strong Roots Make High Corn Yields
CC-10-53 More Effective Fertilizer Use Needed in the Northeast
DD-10-53 Sampling Soils for Chemical Tests
EE-10-53 Some Relationships Between Leaf and Soil Potassium in New Jersey Apple Orchards
FF-10-53 Testing and Reclaiming Alkali Soils
II-11-53 The Importance of Legumes in Dairy Pastures
JJ-11-53 Boron—Important to Crops
KK-11-53 A Convenient Quick-test for Potash in Coastal Plains Soils
MM-12-53 White Birch Helps Restore Potash-deficient Forest Soils
NN-12-53 Continuous Plant Cover—the Key to Soil and Water Conservation
OO-12-53 General Rules Concerning Plant Nutrients
B-1-54 High-level Fertility Makes Balbo Rye Roots More Effective
C-1-54 Soil Test Summaries Can Be of Value to Many Groups
D-1-54 Relation of Potash and Phosphate to Cold Injury of Moore Pecans
E-1-54 What Shall We Eat?
G-2-54 Wisconsin Tops the Nation's 1953 Average Corn Yield
I-2-54 Lime and Fertilizer Pay Off
J-2-54 Feed in the Northeast—Buy It or Grow It?
K-2-54 Soil and Plant Analyses Increase Fertilizer Efficiency
L-2-54 Alfalfa Regains Favor With Tennessee Farmers
M-3-54 Peanut Production Trends in North Carolina
N-3-54 Fertility of Georgia Soils as Shown by Soil Tests
O-3-54 A New Spray for the Cure of Lime-induced Chlorosis
P-3-54 Some Aims of Soil Research
Q-3-54 Fertilize By Test—Not By Guess!
R-3-54 Soil Fertility (Basis for High Crop Production)

THE AMERICAN POTASH INSTITUTE

1102 16th STREET, N. W. WASHINGTON 6, D. C.

Four little children were discussing their arrival in the world. Bobby said he was bought at a department store. Alice said her parents bought her from a stork, and Sue Ellen asserted that she was bought from a doctor.

Then little Agatha piped up.

"My folks were too poor to buy me," she said. "I was home-made."

* * *

A very pretty redhead window-shopping on Fifth Avenue was being followed by a smooth Latin type. She turned on him indignantly. "You've been following me for three blocks—I saw you. You can stop right now. I'm not the type of girl you can pick up."

The Latin bowed and smiled. "Madam," he said, "I am not picking you up. I am picking you out."

It worked!

* * *

Sergeant: "When I say 'fire', I want all of you to fire at will."

Just then a recruit leaped to his feet and disappeared like a scared rabbit.

Sergeant: "Who was that?"

Another Recruit: "That was Will."

* * *

A go-getting press agent succeeded in having printed in a radio column this ecstatic item, "When not facing the microphone or TV camera, X—, the songstress, can always be found on a pair of skis." Which prompted one of the comics to retort: "She must have a h— of a time taking a bath."

Rastus (at the dance): "Mandy, is your program full?"

Mandy: "Lawdy, no; it takes mo' dan two sandwishes an' a cup of tea to fill my program!"

* * *

The best way to tell if a politician is alive is to look at his mouth—if it's closed, he's dead.

* * *

There was once a Texas rancher who could look at any herd of cattle and, inside of three seconds, tell just how many animals there were in the herd.

A stranger to the section bought several thousand acres of grazing land and filled it with cattle. Hearing about the counting rancher, the stranger took him to the top of a hill where they could look down on a large herd. "Can you tell me how many cattle are in that herd?" asked the stranger.

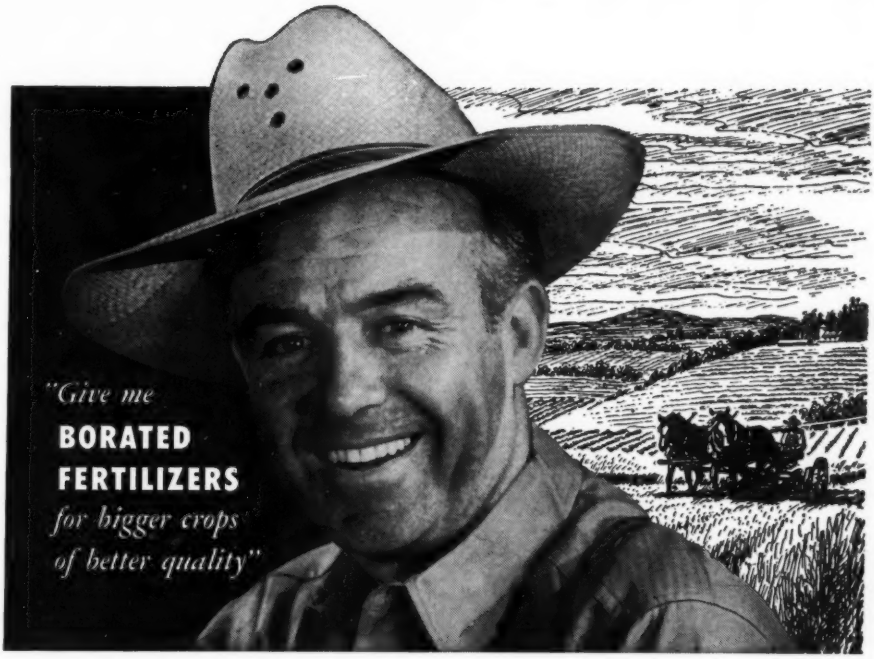
"Fifteen hundred and six," the rancher replied without hesitation.

Somewhat surprised, the stranger said, "That's right. But let's go to the other side of the hill and see if you can guess how many cattle are there."

"I don't guess. I tell exactly how many," said the rancher, walking to the other side of the mountain. "There are more down there—let's see. There's twenty-two hundred and sixteen—no, seventeen, animals in that herd."

"Gosh!" exclaimed the stranger. "How do you do it?"

"It's easy," answered the rancher casually. "I count their feet and divide by four."



BORAX restores lost boron to soil

Yes, Borax does restore lost Boron to soils... the Boron that is so essential to fine, healthy crops and big yields. Although the amount of Boron required is extremely small, its importance is comparable to Nitrogen, Potash and the other essential plant foods. Don't let a Boron deficiency in soil cause crops to dwindle and plants to grow puny. Use Fertilizer Borates, the low-cost fertilizer grade of Borax, to restore the boron—then watch the yields of alfalfa, pasture crops, and many vegetable, field and fruit crops as well, increase and improve in quality!

FERTILIZER BORATE (*equivalent to approximately 93% Borax*) and FERTILIZER BORATE-HIGH GRADE (*equivalent to approximately 121% Borax*) come in fine mesh for addition to mixed fertilizer, or coarse mesh for direct application where required. This material saves you important money in cost of transportation, storage and handling, etc., because water content is held to approximately 24% water (5 mols). County Agents or State Experimental Stations should be consulted for detailed recommendations. Write today for literature!

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